THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

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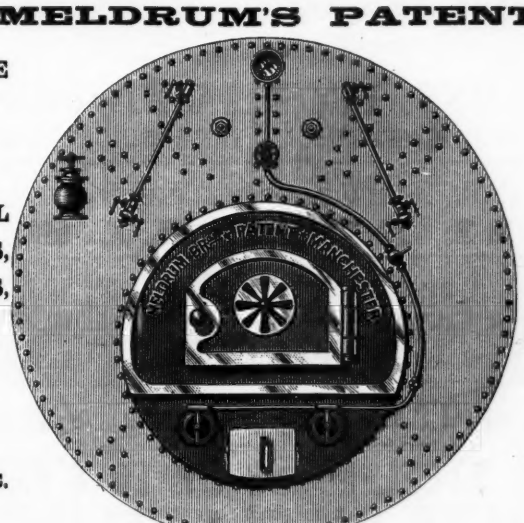

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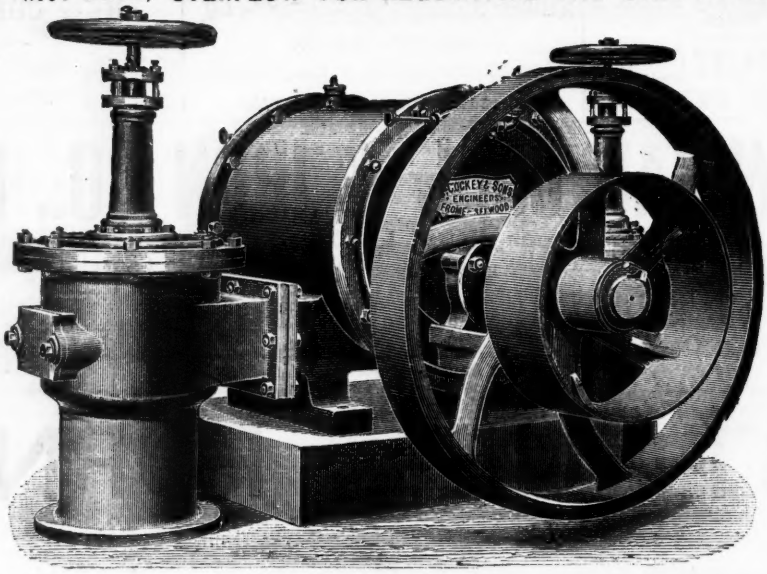

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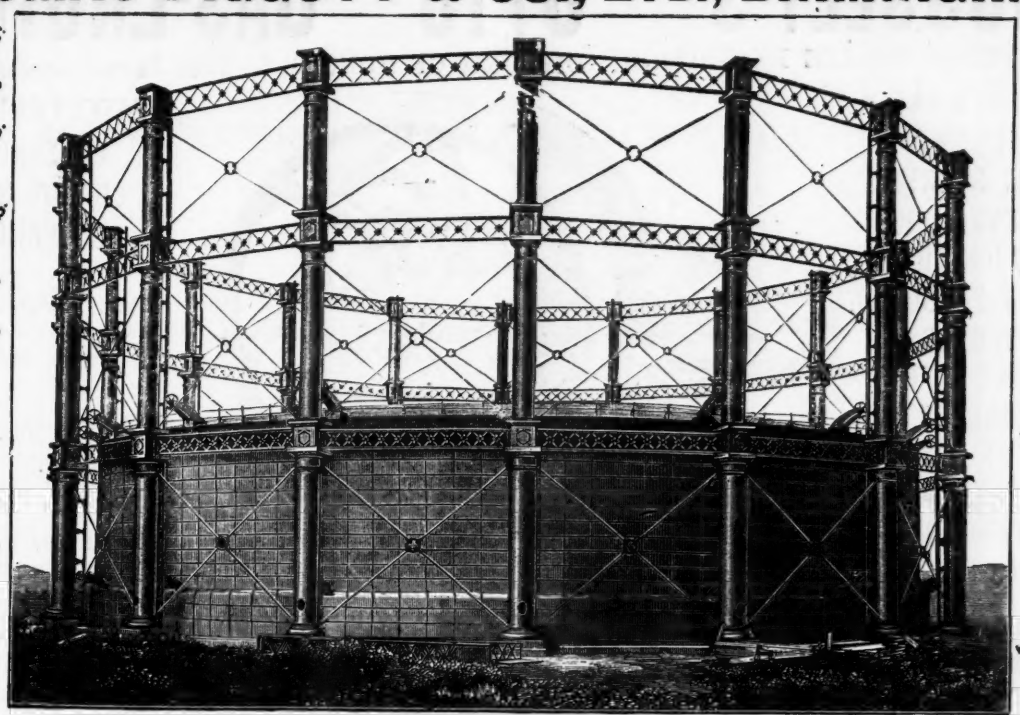

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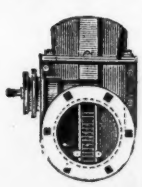

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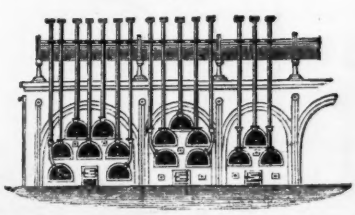

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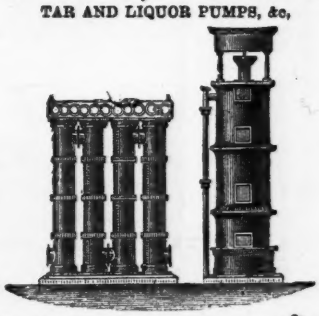

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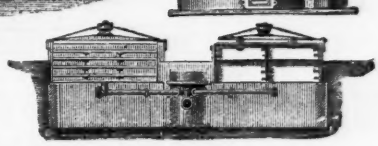

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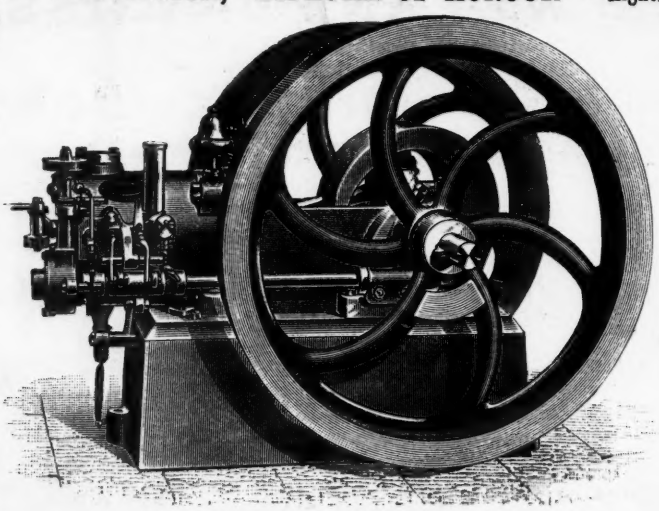

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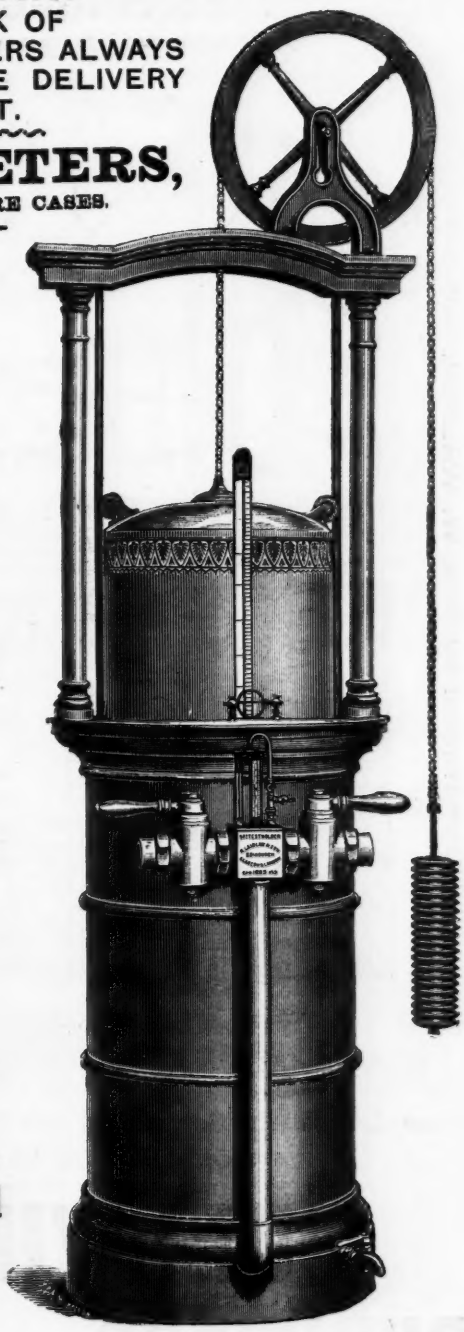

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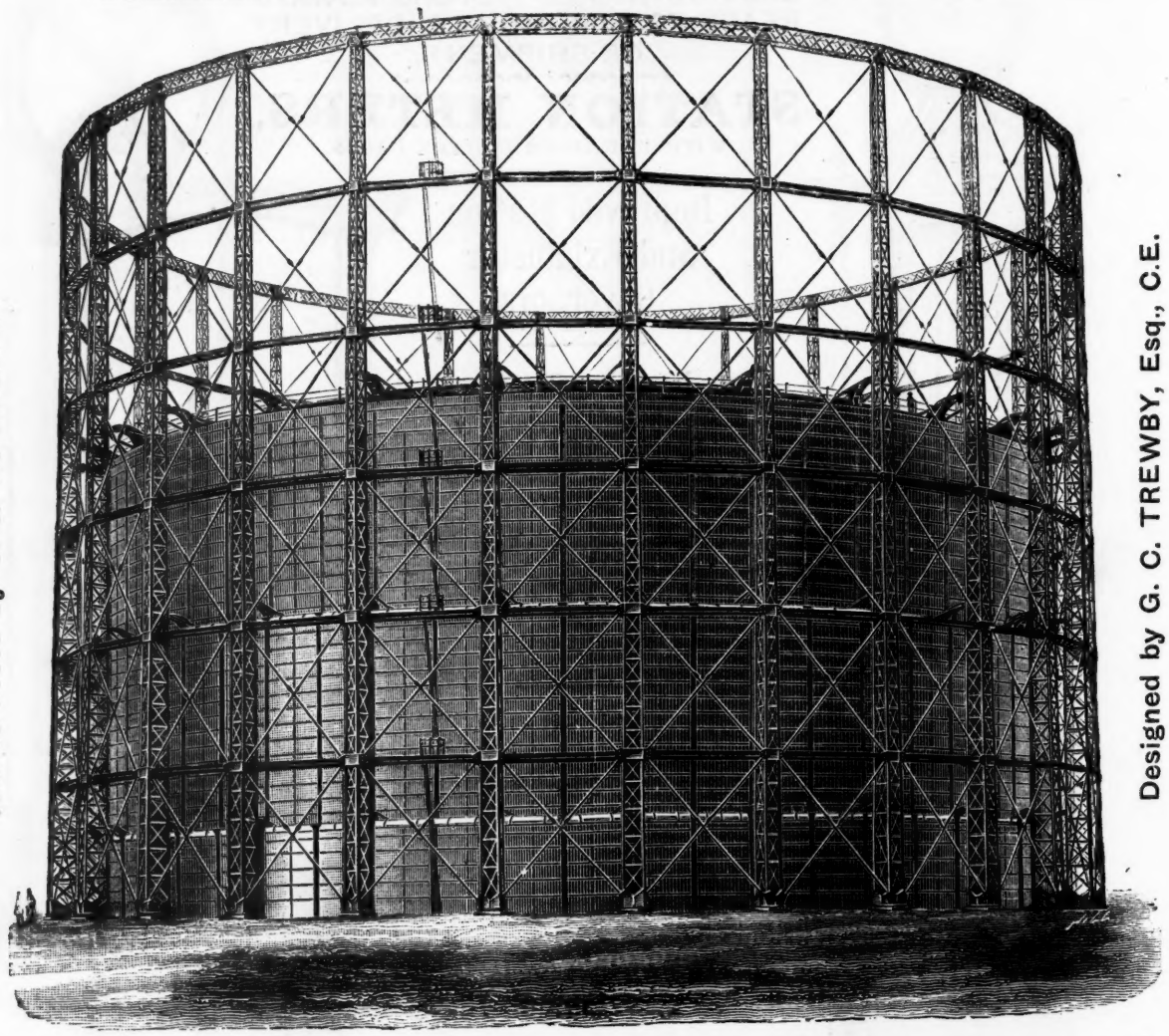

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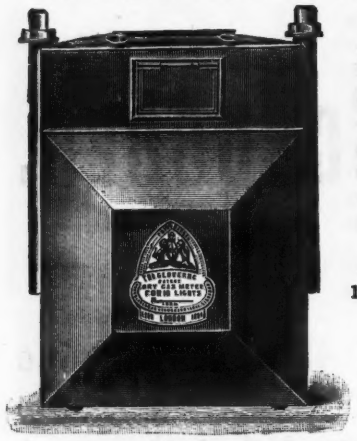

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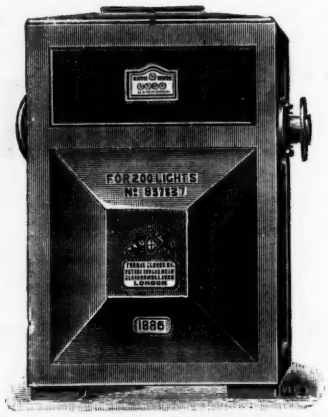

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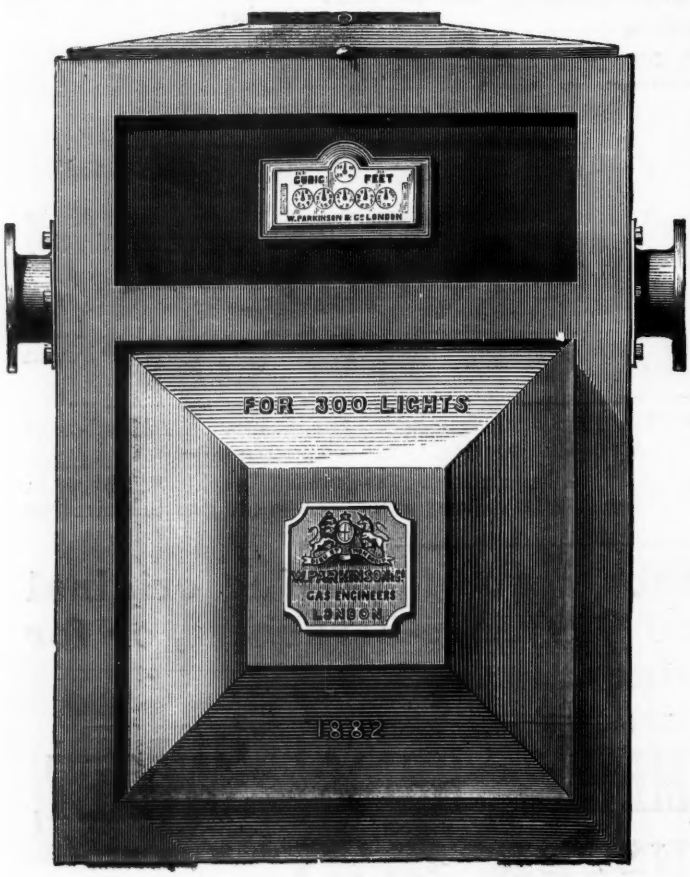

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JOURNAL OF GAS LIGHTING,

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TUESDAY, APRIL 25, 1893.

Last Year's Gas Making in London.

ACCORDING to custom, we give in another part of the present issue of the JOURNAL our analytical statement of the working of the Metropolitan Gas Companies for the past year. This is the most condensed form in which the results of the year's gas making for London can be studied by those who are interested in the subject—which is as much as to say, the whole gas engineering world. The first fact to be noted is the amount of capital, including stock and borrowed money, sunk in the gas supply of London, which has now attained the sum of £16,141,967; being an increase of £405,713 for the year. It has often been asked whether any attempt should be made to reduce this burden upon the Metropolitan gas industry; but the very magnitude of the figures forbids anything of the kind. The capital goes on piling up year after year, while the business and the revenue do not always respond. Thus the last year's capital additions brought up the burden per ton of coal carbonized from £5 5s. 5·44d., at which it stood in 1891, to £5 10s. 11·99d., which is a movement in the wrong direction.

The gross income of all the Companies amounted to £5,200,539, as compared with £5,107,205 for 1891, which was brought about by increases of the selling price of gas. Chiefly by this means the average gas-rental per ton of coal was raised from £1 4s. 6·76d. to £1 6s. 7·64d.; the increase being largest in the case of the Chartered, where it rose from £1 5s. 8·07d. to £1 9s. 6·90d. Notwithstanding all that has been heard about the extension of other systems of public lighting, the Companies earned £2529 more under this head. Residuals, however, betray a serious falling off; the total diminution of revenue in this respect being no less than £265,667, corresponding to a drop in value per ton of coal carbonized of from 8s. 10·36d. to 7s. 3·22d. per ton of coal. In view of the controversy that has raged over the question of the residuals traffic of the different Companies, it is of interest to note that, for the first time in recent years, or since the Chartered Company began to convert their own residuals, this Company have fallen behind their rivals in regard to the returns from this source. Last year the Chartered made only 7s. 0·76d. per ton, as against 6s. 11·46d. in the case of the Commercial, and 7s. 11·37d. for the South Metropolitan Company. This is how the totals work out; but if the different residuals had been taken separately, the loss would be seen to come chiefly under the head of coke.

Expenditure upon revenue account shows a great alteration for the year; the gross total having dropped from £4,063,077 to £3,783,123, which is an economy of £279,954. The decrease is, of course, mainly in the item of coals, which cost £252,059 less; and in wages there is the respectable decrease of £37,186. Coals cost on the average 13s. 11·11d. per ton last year, as compared with 15s. 3·12d. for 1891. But there is still a remarkable difference between the expenditure of the Companies on this account; the same supplies which cost the South Metropolitan 12s. 7·80d. per ton costing the Commercial Company 13s. 10·93d., and the Chartered Company 14s. 4·55d. It costs the Companies different rates, moreover, to turn the coal into gas. Salaries and wages in the manufacturing department run to 3s. 3·24d. per ton for the South Metropolitan Company, who pay the same wages as the others, and have a profit-sharing scheme besides; while the Chartered spend on the same account 3s. 6·71d., and the Commercial 3s. 10·36d. per ton. In all probability, the explanation of this difference might be found under the terms "Trades Unionism," and "Machinery." There is not much to be said concerning the other entries in these accounts; but attention may be drawn to the fact, which will appear strange to those who are given to talking at random about the "huge profits" of Gas Companies carrying on their business under statutory conditions, that last year the gross profit of all the London Gas Companies works out to no more than £8 15s. 8d. per cent. on the stock and borrowed money, which means that many shareholders and lenders received very much less upon their investments.

Considerable interest attaches to the working statistics of the London gas undertakings which appear in the following table:—

TABLE *of the Residuals and Gas made, per Ton of Coal carbonized, by the Metropolitan Companies in the Year* 1892.

Name of Company.	Coke per Ton of Coal, in Bushels.	Breeze per Ton of Coal, in Bushels.	Tar per Ton of Coal, in Gallons.	Ammoniacal Liquor per Ton of Coal, in Gallons.	Gas Made, Cub. Ft. per Ton.
CHARTERED . . .	44·24*	3·10*	10·09	28·71	10,285
COMMERCIAL . . .	47·10	5·49	9·71	34·98	9,783
SOUTH METROPOLITAN	48·19	3·80	9·66	35·80	10,056
Mean per Ton . .	45·42	3·45	9·96	30·91	10,192

* The returns of coke and breeze are given in *tons* in this Company's accounts. These have been reduced to bushels on the Company's basis of 9½ cwt. of coke to the chaldron, and 50 bushels of breeze to the ton.

Remarks.—In working out the results shown in the above table, as well as those in the second table on p. 726 the equivalent in cannel of the oil used as an enricher was added to the figures giving the bulk of solid raw material carbonized. Where this equivalent was not furnished in the accounts, it was estimated on the basis at present adopted.

It is difficult to compare one year with another upon the bases given in these tables, because of the organic change

that has been wrought by the substitution of mineral oil and spirit for the cannel formerly used for carburetting London gas. The first point that strikes one as noteworthy in this table is the difference in the yield of coke admitted by the different Companies. This amounts to more than a bushel per ton as between the Commercial and the South Metropolitan Companies; but how can one account for the discrepancy between the Chartered and South Metropolitan returns? Taking the tables for the last two years, both these Companies confess to a falling off in the production of coke; while the Commercial admit a slight improvement. The returns for the last undertaking are indeed very concordant for the two years, in which respect they are closely followed by the Southern Company. The Chartered, however, redeem a diminished output of coke and other residuals by a sudden gain in the rate of gas made per ton of coal. In this connection, the thought again arises of the part played by petroleum in providing the material for these accounts; and the conclusion is forced upon one that great caution is desirable in interpreting the figures as they stand. There is nothing in these statements to show that the Companies have adopted water gas, even upon an experimental scale; whereas it is matter of common rumour that the Chartered make a considerable proportion of this kind of gas at more than one of their stations.

Oil Gas for Edinburgh.

In another column will be found an important report by Mr. F. T. C. Linton to the Edinburgh and Leith Gas Commission upon oil-gas processes, which concludes with a recommendation to the Commissioners "to erect plant "for the manufacture of oil gas as soon as it is possible to "do so;" this plant being on Mr. William Young's system, and the resultant gas being intended to carburet gas from splint coal up to the present Edinburgh standard. For several reasons, this is one of the most important steps in the introduction of oil gas into British gas-works that has yet been recorded in the Journal. We assume that Mr. Linton's advice will be acted upon, and that the extensive plant which is to be constructed according to his designs at the New Street Gas-Works, Edinburgh, will be started at the earliest moment. This new departure will then mark an era in the North British gas industry which may have widely-spreading consequences. At any rate, the effect upon the cannel trade of the decision of the Edinburgh and Leith Gas Commission cannot be otherwise than serious; and it is a triumph for Mr. Young, upon which this gentleman is to be heartily congratulated. Scotland and the North of England, with their gas of high illuminating power, have been waiting for the last two or three years for a suitable substitute for cannel. It is one thing to use oil and spirit, as the London and other Southern Gas Companies have done, to bring up a 15-candle gas made from Durham coal to the statutory 16-candle standard; but it is something altogether different to produce a 26-candle gas, such as the Edinburgh people have been accustomed to, and which, despite the example of Glasgow, they are apparently determined to retain. Mr. Linton has gone very deeply into the question of the comparative value and cost of cannel and oil as gas-making materials: and his figures stand for anybody to criticize. We have no present intention of discussing these computations, but merely refer to the matter in a general way in order that so serious an innovation as that to which Mr. Linton has committed himself may not escape the attention its importance deserves.

Mr. Gladstone and the Miners.

An interesting discussion upon the question of a compulsory eight-hour day for coal miners took place last week between Mr. Gladstone and the members of a deputation from the miners of Northumberland and Durham, who belong to the Miners' National Union—a body that entertains views upon the subject diametrically opposed to those put forward by the Miners' Federation. It will be recollected that a deputation from the latter body, with which Mr. Pickard is identified, had an interview with the Prime Minister a short time ago, and expressed opinions generally supporting the desirability of a legal eight-hour day. The Federation, in short, appears to be deeply tainted by the Socialistic nonsense that has also made the term "New "Unionism" a byword for all that is impracticable and tyrannical. The Miners' National Union, on the other hand, incline to place a continuing faith in the ability of adult labour to obtain its wants without the interference of Parliament. This organization does not habitually make quite so much noise in the world as the Federation; and accordingly we find them explaining to Mr. Gladstone—not altogether without a tinge of sarcasm—that they deemed it necessary to send a deputation up to Downing Street lest their quietness might be altogether misunderstood. The northern position, as described by Mr. R. Young, is that "interference with "adult labour by Parliament is not the proper thing, and "for economic reasons the difficulties to be encountered "in establishing an eight-hour day are insurmountable." In addressing the deputation, Mr. Gladstone said that "belonging, as he necessarily did, to an old school of "politics, his prepossessions, apart from his reason as well "as his reason, whichever it might be, were with them;" and also that "it was an enormous advantage in the view "expressed that it proceeds on the principle of respect for "individual freedom." The Prime Minister went on to say that "he was persuaded that the true interests of the "entire working classes of this country are bound up with "that respect for individual freedom; and that to over-"look it or to bring the smallest interference, and restrict "it, unless under absolute necessity, would be a sad "mistake on the part of the working classes; and above "all this, he would point out that in bringing about this "interference they would be creating precedents without "knowing it, which, under given circumstances, might be "turned against them." All this must be gall and wormwood to the New Unionist supporters of the right honourable gentleman, who are waging at Hull a desperate assault upon the principle of freedom of labour for all who wish to work.

Trades Unionism and the Government.

There is one interesting point in connection with the "last stand" of the Dockers' Union at Hull that has not received the attention its importance merits at the hands of the gentlemen who manufacture public opinion through the agency of the newspaper press. In the course of the incessant negotiations for a compromise that have been got up by the friends of the New Unionists to cover the collapse of this variety of Trades Unionism in the place where it has had the fullest and fairest trial, mention has been made of the Free Labour Registry set up in Hull under the Shipping Federation. The Unionist party wanted this establishment closed, or at least transferred to the management of an official appointed by the Board of Trade. The Federation declined to entertain this suggestion, on the ground that the recent action of the Board in the matter of the appointment of correspondents of the new Labour Department shows that the Board have already taken a side in the question of employers and employed. It is asserted with perfect truth that, with scarcely an exception, all these new appointments have been given to Union delegates. Consequently, the heads of the Shipping Federation have no confidence in the impartiality of the Board in dealing with the claims of Free Labour. This is one of the gravest imputations that could possibly be brought by a responsible section of the community against a Department of the Executive. The fact that it should be possible to formulate such a criticism upon the Board of Trade is a very bad augury of the future working of the experiment to which the Board stand committed. It has been a characteristic of British Governments up to the present time to preserve absolute independence of all popular organizations, whether of the labouring class or of any other, intermeddling with which might drag an Administration into industrial or commercial disputes. In the same way "politics" have been rigorously kept out of these popular organizations, so that hitherto one would as soon have credited with political influence the President of a Young Men's Christian Association as the Chairman of a Trade Union. All this, however, is now to be changed, upon the initiative of Mr. Mundella, who in the manning of his new Labour Department has not looked beyond the New Unionists, but has seemingly simply selected the "delegate" with the most impudence as representing "the labour interest" in his own neighbourhood. The result will be that employers generally will take the view of the Department expressed by the Shipping Federation, and have nothing to do with it. If such should be the result of Mr. Mundella's action, this well-meaning statesman will have little reason to plume himself upon his

departure from the tradition of his predecessors in office. Nor will the cause of Trades Unionism benefit from the political patronage which is being forced upon it. The Unions are managed badly enough now, in all conscience, when they are useful for little else than to support in a kind of public life men like J. H. Wilson, Ben Tillett, Tom Mann, and others. If the members like this return for their subscriptions, it is nobody's concern but their own. Once let the Unions be branded with the colours of political parties, however, and let it be understood that their strength, personal and financial, is to be used for political purposes, and the advent and extension of corruption, striking both upward and downward, is only a question of time. It is a "far cry" yet from a John Burns to a "Boss Tweed;" but the pace in political development is fast now-a-days.

The State of Affairs at Hull.

THERE is not much to be said specially respecting the actual state of the labour dispute in the shipping trade beyond that the loudly-trumpeted intention of the agitators to bring about a "national strike," with the fantastic object of coercing the Hull shipowners, has had the result we anticipated—that is to say, it has come to nothing at all. In Hull itself, each day that has elapsed since the Dockers' Union made their impudent onslaught upon the rights of free labour has strengthened the position of the employers who refused to lie any longer under the Union yoke. Every day has witnessed the introduction of more free labour; and the shipowners, who were not unwilling at first to let things go slow, have altered their hand, and are no longer inclined to allow the trade of the port to be at a standstill while the strikers are making up their minds whether or not they will return to work. Moreover, Hull has a back door open to the German Ocean; and, while the strikers have been parading the streets, shiploads of Dutchmen have been landed in the docks. Meanwhile, the local men who are standing out in the vain hope that Ben Tillett and J. H. Wilson will be able to work a miracle on their special behalf, are being reminded that they are at perfect liberty to return to work whenever they please, and take up any jobs that may be left for them to do, on the one indispensable condition of working peaceably with such men as they find there. Nobody asks them to take a Federation ticket, or even to sign a register; and the longer they stand out, the more assured will be the footing of the temporary labourers who are taking their old places. "As for the 2500 free labourers, or thereabouts, who have "now been brought into Hull, such of them as wish to "remain when their engagements have expired, or when "the strike is over, will be at liberty to do so; and to this "extent at least there must be a displacement of local "labour, whatever the final issue of the conflict may be. "Positive assurances are given that employers will not, "merely to find places for the strikers, turn their backs "on the men who have come to their assistance." This is the moral of the South Metropolitan strike over again. The public will have ample opportunity of seeing which party—the masters or the strike leaders—will keep their words; but what a heavy responsibility lies upon those outsiders who, by newspaper articles and otherwise, have encouraged the strikers to proceed to their ruin in the cause of Union tyranny!

Death of Mr. J. Heydon.—We regret to record the death of Mr. Joseph Heydon, who for a period of fourteen years held the position of Manager of the Mansfield and Mansfield Woodhouse Gas-Works.

The Purifier Contract for the Dawsholm Gas-Works.—We learn that the contract for the erection of the purifiers, valves, and connections, and the roofing of the purifier and meter houses, at the Dawsholm Gas-Works of the Glasgow Corporation was entrusted to Messrs. C. and W. Walker, of Donnington, and not to the Barrowfield Iron Company, as stated last week in our report of the "Informal" Meeting of Gas Managers in Glasgow.

A Projected Welsh Watershed Syndicate.—The *Financial News* understands that, pending the report of the Metropolitan Water Commission, a Syndicate is being formed to deal with the rights over the few remaining Welsh watersheds available for the supply of the Metropolis and towns *en route*. Our contemporary believes the project is viewed with favour by such territorial magnates as the Duke of Westminster, Sir Watkin Wynn, Mr. Lloyd Price, and Colonel Mainwaring.

WATER AND SANITARY AFFAIRS.

DR. FRANKLAND'S report on the character of the Metropolitan Water Supply during the past year has been issued by the Registrar-General. It states that, with regard to organic impurity, the Thames water distributed in 1892 was, on the average, of much better quality than that supplied the previous year, and an improvement is also ascribed to the Lea water. In fact, the tables would make it appear that the proportion of organic impurity present in the deep-well water, as delivered in London, was the same as in the water distributed from the Lea; the figure being in each case 338, as compared with the standard of 1000. But Dr. Frankland goes on to say that the Lea water delivered in 1892, while better than that of 1891, was "worse than that in any previous year since 1883." If so, the figure 338 for last year looks like a misprint. Yet in another table, referring to the winter months of the year only, we find the total combined nitrogen in the Lea water given as 0·332; while we are told that the figure for the deep-well waters throughout the year rises to 0·349, if we exclude the wells belonging to the East London Company. Including those wells, the proportion falls to 0·271. One thing appears to be sufficiently clear. It is that—measured by the organic carbon and nitrogen—the New River supply has an amount of organic matter as low in the minimum as that of the Colne Valley, and less than that of Tottenham. Among deep-well waters, the Kent Company's supply had the least proportion of organic matter; having, on an average, rather less than half that of the Colne Valley. The excellence of the New River water is also a marked feature; while the East London supply transcends the waters derived from the Thames. Among all the supplies, whether from the Thames, the Lea, or the deep wells, the examinations for turbidity yield good results, after the manner of recent years. In no instance was a sample found "very turbid." One that was simply "turbid" appertained to the East London Company, and very oddly this came from a deep well; while one "slightly turbid" came from the same source. In like manner the Tottenham Local Board of Health had two "slightly turbid" samples from deep wells; while the river supply only furnished one such instance, for which the Southwark Company were responsible. That the deep-well waters should give three "slightly turbid" samples, while the river supplies gave only one, certainly seems somewhat strange.

After all, the grand test of the wholesome character of the water supply is that which deals with the living organisms. The invention of the bacteriological mode of examination is a most fortunate thing for the London Water Companies, and for the right understanding of an important sanitary problem. For years past, it has been argued that, although the organic matter in the water supply is often quite insignificant, yet it may be of the most objectionable character on account of its origin. The "previous animal contamination" has been associated with the idea of disease germs perilous to the public health, although undiscovered by the chemist. Science now enables us to grapple with this vague terror. The germs, whatever they may be, are arrested on their way. They are either buried in the subsiding reservoirs, or slaughtered in the filter-beds. If any escape, they are but a scanty remnant. We are no longer left helplessly to count the footsteps of an invading army; but we are able to capture or kill the individuals themselves. The question may be raised whether it is worth while to go on counting the footsteps; seeing that the organic impurity practically resolves itself into the amount of bacteria. The total combined nitrogen will not hurt us. The physiological result is settled by the germs. Dr. Frankland says: "The transport of pathogenic "microbes renders efficient filtration of the river waters "supplied to the Metropolis of the very greatest "importance from a hygienic point of view." This is perfectly true; and what do we find? The average number of microbes per cubic centimetre discovered last year in the water supply of the Chelsea Company was seven; while the deep-well waters of the Kent Company yielded six. In November, the Kent microbes were 12; and the Chelsea, only four. Of course, filtration did its work in the river water; the Kent supply needing no

filtration. But how marvellous has been the reduction. The seven of the Chelsea supply correspond to very nearly 3000 in the raw river water. Under the like circumstances, the West Middlesex Company had 13 microbes per cubic centimetre in their supply; and the Lambeth, 33. The East London Company, having to deal with nearly 5000 microbes, reduced the number to 27. In December, they had 15,000 microbes in the raw river water at their intake; but they allowed only 134 to pass into the supply. That any of the escaped microbes were of a pathogenic nature is extremely unlikely; and certainly the risk is very remote. But we may carry the contrast still further. In the first four months of the year, the deep wells of the Kent Company had on an average 66 microbes per cubic centimetre; the number in January being as high as 204, dropping to eight in April. But the average during the four months was only 24 in the West Middlesex supply, 52 in the Chelsea, and 53 in the Grand Junction; the New River having 66. The results are at once striking and encouraging. Merely as a second line of defence, Dr. Frankland recommends double filtration, though, of course, water from the gravel beds will not need it. One of the odd things with regard to the microbes is that they are most numerous in cold weather; the number increasing enormously when the freezing point is reached. This was not to be expected, but seems to tell in favour of the public health.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 745.)

THE unfavourable influences affecting the Stock Markets which we noted in our last issue were so unsettling as to predispose the public not only towards caution, but even as far as some degree of timidity. And this tendency was emphasized to a certain extent in the week just now closed by further disquieting events. The further fall in Australian banks, coupled with another failure, the apprehension of general trouble and impediment to business proceeding from an extended strike, fiscal and financial affairs in the United States, and uneasy glances towards the East, which were by no means relieved by reports as to projected movements by the French in the direction of Egypt, all tended to keep the public mind in a state of apprehension, and to check anything like a resumption of enterprise. The natural demand for outlets for money, however, has had the usual effect; and the gilt-edged securities have been forced up higher. The Money Market shows no change; and whatever may be the requirements for the settlement this week, they will be readily forthcoming. The Gas Market has been considerably quieter than it was the week before—in fact, business was quite at a low ebb. The general firmness, however, is still most conspicuous; and the growth of sound gas undertakings in the public favour is progressing by marked steps. Owing to the paucity of business, there are but few changes in quotation to be noted; and these are mostly in the choicest issues—a result which doubtless proceeds from the universal demand for everything of the best quality for investment. In Gaslights, the "A" had its full proportionate share of transactions, and was done steadily at the narrow range of about 221½ to 222½. The secured issues were, as usual of late, in good demand, and changed hands at nice prices; but the only move was a rise of 2 in "C," "D," and "E." South Metropolitans were very firm, though not very active; and the debenture stock improved 3. Nothing at all was done in Commercials. The Suburban and Provincial undertakings offer no feature for remark beyond an advance in British. Continentals were brisk and very strong. Union and European have advanced in price; and the figures realized for Imperial would seem to justify a higher quotation. Among the rest, the only noteworthy point is the unfavourable report of the Bombay Company, who, owing to the depreciation of silver, are compelled to reduce their dividend to a 6½ per cent. rate. The Water Companies were firm and quiet; the only move being a rise in Lambeth.

The daily operations were: The Gas Market opened steady at last closing prices, and remained firm, with very moderate business. European rose ½. In Water, the only deal was in Lambeth, which rose 2. On Tuesday everything touched fetched very high figures; but quotations did not stir. Wednesday was a quiet day; but its strength was decidedly marked. Continental Union and British rose 1 each. Thursday was quieter still; but prices kept moving up, with a rise of 2 each in Continental Union and Gaslight "C," "D," and "E." Lambeth Water was 1 higher. Friday brought no increase of activity; but South Metropolitan debenture rose 3. The week closed on Saturday with general firmness; all quotations remaining unchanged.

ELECTRIC LIGHTING MEMORANDA.

The Electrical Industry in the United States—The Use of Storeage Batteries in England and America—The Prospects of Municipal Electric Lighting Ventures.

As an illustration of the extent to which electrical industries have spread in the United States during the past fifteen years, it is stated in a recent directory that more than 1850 of the cities and towns of the States are now supplied with central-station electric plants of some kind; while the isolated plants number "several thousand" more, these being apparently in special favour in the textile industries. More than 500 street railways in the States are returned as using electrical power transmission; and the manufacture of dynamos is reported to be carried on in upwards of 50 workshops, "some of them very large ones." This is doubtless important and interesting nformation; but it must be taken in conjunction with some other statements which we recently published respecting the character of American electrical engineering. It is easy enough to pile up statistics relating to American "cities and towns," that can be made to bear different interpretations according to the point of view from which they are regarded. These geographical terms, moreover, as applied to settlements in the States, have quite a technical meaning. It would probably be found upon inquiry that the big totals which look so imposing in American electrical directories are subject to heavy discounts, if tested by the European standard of meaning of the terms employed in the compilation.

Professor George Forbes has been in America lately, attending the National Electric Light Convention at St. Louis, to which assembly he has expounded his views on the subject of municipal electric light stations, with special reference to that remarkably clever scheme of his own for Edinburgh, which does not appear to have any immediate prospect of realization. It is in the highest degree desirable that these international meetings of men of science and technicians should take place occasionally, because of the light shed by this means upon divergencies of practice which seem so often to follow national lines. It has often been remarked as curious, for example, that, whereas English electricians make extensive use of storeage batteries in connection with electric lighting plants, there is nothing of the kind known in the United States. The trade in these batteries is a fairly good one in this country; while in the States it is a most pronounced "frost." The reason for this difference may be gathered from the reported discussion at St. Louis between Professor Forbes and his American friends. It is simply that the storeage battery is a very costly means of effectuating something which is held to be indispensable in this country, but which the American public have never learnt to expect—a high degree of constancy in an electric lighting service. The storeage battery is in no sense a generator of electricity; and the part which it plays in the economy of some British central stations is only done at a considerable advance of cost upon the dynamos and steam plant displaced by it. Saving by its use there is none, but rather more outlay in both first cost and maintenance. Therefore, an American electric light manager fails to see any advantage in the appliance.

It might be reasonably asked how it is that there is still so much uncertainty respecting the prospects of electric lighting enterprise with regard to any particular town, or part of a town, that special reports are called for when there is a question of carrying out an Electric Lighting Order. The truth of the matter is, that no perfectly general formula for working out the economic problem of all such undertakings exists. Some ventures of the kind contain the possibilities of what may be called success; but there is no certainty anywhere, and the study of electrical experts for many years to come will be a watching of the principle of "the survival of the fittest," as exemplified in the experiences of the municipal and other speculators in this line. This may not be a very comfortable observation; but it is the only safe deduction that can be drawn from the spectacle presented by the British electric lighting industry at the present time. So far as the forecasts of experts go, there is not an electric lighting venture in the kingdom that has other than the brightest prospects. It would be difficult to find a town so unfavourably situated or circumstanced, that no eminent gentleman accustomed to this kind of prophetical exercise would promise the municipal authorities a handsome profit on a central-station lighting plant. On the other hand, it would not be easy to name a town wherein an electric lighting speculation, municipal or otherwise, could now be started with such assurance of paying its way as an impartial financier could respect. The bearing of these observations lies upon the fact that few electric lighting speculations other than municipal—that is to say, supported out of the public funds—are now to be looked for. The year that is passing is one of the dullest for the promoters of joint-stock enterprise that has ever been known; but nobody thinks of going in for electric lighting with a hope of profit, though from one point of view there is plenty of room for it. The fact should inspire local authorities with extreme caution when approached (as so many of them are just now) by plausible gentlemen, who would repel with scorn the imputation of being emissaries of electrical contractors in need of a job, but who profess a curious interest in seeing the place of their temporary sojourn "abreast of the times" in electric lighting.

COAL, SOOT, AND SULPHUR COMPOUNDS.

THE magnificent weather that has redeemed the character of the English Spring in the estimation of the present generation, and has had the effect, among others, of precipitating by some weeks the annual household crisis known as "leaving off fires," will probably work the further result of postponing all discussion of smoke abatement projects until the gloom of another winter comes to convince the British public that the much-vaunted "march of improvement" is at a standstill, so far as the domestic fire-grate is concerned. Until lately, the interest of British gas manufacturers in the smoke abatement movement might have been regarded as Platonic; for although the gas-cooker and the gas-fire are among the best accredited agencies for reducing the smokiness of the atmosphere of British towns, or at least for preventing its increase in the ratio of the increase of population, gas managers are well aware that it is not this quality that recommends these articles to the patronage of ordinary gas consumers. It is not the purification of the atmosphere, but the reduction of domestic labour and of housekeepers' bills, that attracts people to gas appliances. If the multiplication of gas-works has a beneficial effect upon the atmosphere of a town, so much the better for the town; but this is not a consideration that will be likely to weigh with many people, until the standard of public spirit becomes very much higher than it is at present.

For the same reason, we are always disposed to receive with a feeling of pity the declarations of smoke abatement enthusiasts, in favour of making the claims of aerial sanitation paramount in determining the kind of fire-place and heating and cooking arrangements which people shall be permitted to use in their houses. This is chiefly a question of comparative expense and convenience. As soon as the process of exhausting the coal capital of the country, which is continuous, shall have put an enhanced value of a few shillings per ton upon house coal; and whenever the time shall come for the Domestic Servants' Union to protest effectually against the tyranny of the employer class in expecting fires to be laid and lighted in the degraded antique fashion—then the common, smoky fire-grate may be expected to disappear from British homes. Meanwhile, however—as the recent experience of the South Metropolitan Gas Company showed—gas manufacturers may have a very close and practical interest in the subject of aerial sanitation, altogether apart from that which appertains to them in their quality of dealers in stoves. The neighbourhood of the Old Kent Road is not the only locality where increasing density of the population brings into prominence the various agencies by which the atmosphere may be robbed of its pristine freshness. The more houses, the more chimneys; the more chimneys, the more smoke, the more and thicker fogs; and the more objectionable in public estimation become those manufacturing and industrial operations involving the production of noxious or unpleasant gaseous emanations which would hardly be noticed on their own account.

For these reasons, much interest attaches to such investigations as Dr. J. B. Cohen and Mr. G. Hefford have been engaged upon at Leeds, some results of which have been communicated to the Yorkshire Section of the Society of Chemical Industry. These chemists appear to have had their attention directed to the importance of the sulphur in coal, from other than the manufacturing point of view. Gas managers know what sulphur in coal means to them; but the effects of sulphur when coal is burnt in a furnace or a common fire-grate are by no means negligeable. For instance, sulphur may seriously affect the quality of iron in blast-furnace operations; or it may attack, when burnt in a boiler-furnace, the plates of the boiler. "The effects of the sulphur dioxide, which gets into the atmosphere, oxidizes there to sulphuric acid; and then commences a raid upon stonework, brickwork, vegetation, and the human respiratory organs, is often mentioned as an evil. But the evil not being readily estimated in pounds, shillings, and pence, is not regarded as seriously affecting our well-being." Having thus stated the case of the presence and action of sulphurous acid in the atmosphere, the authors proceed to inquire how it comes there; and this brings them to the house-fire as "the chief delinquent in this matter."

Their first care was to determine how the operation of coal burning, as carried on in an ordinary open grate, compares with the performance of a boiler furnace; and they discovered ample corroboration of the fact that combustion in the former case is much less perfect. They burnt samples of the same kind of coal in both ways; and found that, even when the cinders were carefully sifted and reburnt, the open grate left nearly 35 per cent. of cinder, as compared with 24·3 per cent. from the boiler furnace. The proportion of ash was commensurately less, and that of sulphur was higher in the case of the fire-grate. They then proceed to discuss the question of the proportion of coal ordinarily wasted as soot, as to which there is some discrepancy between the records of experimentalists who have published results of their observations on the subject. In 1855, Delezeune estimated carbon which escaped combustion at 5 per cent. of the total weight. He further estimated that 6320 kilos. of soot fell in twelve hours in the town of Lille. This is doubtless incorrect. "From experiments made in Manchester and Leeds, by collecting the snow and determining the daily deposit of soot, the amount which fell in 24 hours per square mile in Leeds was about 250 lbs.; and in Manchester, about double that quantity during fog." The authors mention the analyses undertaken by Roberts-Austen, in connection with the Smoke Abatement Exhibition; and they describe the manner in which they carried on similar work, with the object of ascertaining how much dust (mainly carbonaceous) passes away by an ordinary house chimney—ultimately finding it to be about 4 per cent. of the fuel burnt.

Next comes the question of the sulphur. The amount of sulphur in coal has frequently been determined; and from the difference between that and the sulphur remaining in the clinker, the quantity passing into the air has been ascertained. In a paper read before the Manchester Section of the Society of Chemical Industry, Bailey showed that from 53 to 55 per cent. of the sulphur from the coal escaped into the atmosphere; from 4·8 to 5·4 per cent. remained in the clinker; and 39·6 to 42·3 per cent. went somewhere, but its ultimate destination is left in mystery. Messrs. Cohen and Hefford found experimentally that the distribution of sulphur in a given sample of coal was as follows: Burnt, 71·78 per cent.; in the cinder, 13·71 per cent.; in the soot, 14·51 per cent. A curious remark is made as to the mode in which the sulphur is combined with soot. The investigation has not been carried further than to show that there are present with soot "organic sulphur compounds, which may be extracted with ether, and which are volatile." Now this is precisely the description of the permanent sulphur impurities that are the despair of the gas engineer. It is these that the most artfully-prepared sulphide box is powerless to arrest; and a further remarkable thing about them is that, whereas some of them possess a strong physiological action, others are active in a different way.

This fact comes out from certain researches of Cohen and Hefford upon the discoloration of silver articles by sulphurous fumes. This effect, as town residents know, is the invariable accompaniment of foggy weather. It is "usually attributed to the formation of silver sulphide from sulphur compounds in the air." As sulphur dioxide is the most plentiful of these, some experiments were made with it, both dry and moist, on pure silver, and on silver-copper alloys; "but only in one case was any blackening produced." And this was when the sulphurous acid gas was enclosed in a tube with a little soot. From another experiment, in which foggy air was rapidly aspirated over bright silver-copper alloys, separated by a stout plug of cotton wool, it appeared that the unfiltered air produced less effect than the filtered air. The inference drawn from these experiments is that "solid particles of soot influence in some way the discoloration of silver." The presence of sulphuretted hydrogen in the air must also be allowed for as contributing to the effect; but the quantity of this gas in ordinary air must be very small.

An important contribution to the stock of information relating to the blackening of silver articles in air, has been made by Mr. W. Thomson, who has found that hydrochloric acid vapours in the presence of light produce a greater discoloration than even sulphuretted hydrogen. We are thus led to see that the phenomenon of the blackening of silver and plated goods exposed to the atmosphere is not a simple effect traceable to one cause. It is *not* due to the action of sulphurous acid gas, which is the readiest explanation. It may be due to sulphuretted hydrogen, where this exists in the air, or to hydrochloric acid vapours; but in all probability the commonest cause is nothing else than soot. Soot acts upon bright silver in this way because it contains volatile sulphur. What a remarkable combination of influences is here, all pointing towards one result! These points are worth bearing in mind, against future troubles arising out of alleged nuisance created by the operations of coal-gas manufacture and purification. It now remains to learn more about the mysterious organic sulphur compounds resulting from burning or distilling coal, as to which it may be said that very little is known, beyond the facts that they are extremely active in blackening silver, and that some of them are highly poisonous. Gas managers would also call them remarkably troublesome.

Michigan Gas Association.—An Association under the above title was organized on the 29th ult. at Kalamazoo (Mich.), for the advancement of the gas business throughout the State. The President is Mr. S. Dean; the Vice-President, Mr. T. D. Gilbert; and the Secretary and Treasurer, Mr. H. H. Hyde.

The Dunfermline Managership.—In the paragraph on this subject which appeared in the JOURNAL last week, Mr. Hubert Pooley was described as Assistant-Manager of the Birkenhead Gas-Works. This was not quite correct; that position being filled by Mr. F. D. Haines, who has held it for some years. Mr. Pooley was Junior Assistant.

The Returns as to Gas Undertakings.—In the House of Commons, on Monday last week, the usual returns were formally ordered to be made in regard to all the authorized gas undertakings of the United Kingdom—for the year ending Dec. 31, 1892, in respect of those owned by Companies, and for the twelve months ending March 25 last for those in the hands of Local Authorities. As frequent inquiries reach us for copies of these annual returns, we may mention that they are not generally published until early in December in each year.

ACCOUNTS OF THE METROPOLITAN GAS COMPANIES FOR THE YEAR 1892.

—	Chartered.	Commercial.	South Metropolitan.	All the Companies.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Capital and borrowed money	12,058,750 0 0	880,000 0 0	3,203,217 0 0	16,141,967 0 0
Income—viz.:				
Sale of gas by meter	2,782,782 16 1	244,096 16 8	768,287 13 10	3,795,167 6 7
Public lighting, including lighting under contracts	145,567 17 8	18,739 15 7	59,534 3 5	223,841 16 8
Rental of meters and stoves	74,239 2 5	5,517 1 7	24,582 19 6	104,339 3 6
Residual products	699,331 17 6	78,580 17 4	279,046 14 9	1,056,959 9 7
Miscellaneous, including old materials	13,628 14 1	778 8 10	5,824 13 11	20,231 16 10
Total income from all sources	3,715,550 7 9	347,713 0 0	1,137,276 5 5	5,200,539 13 2
Expenditure—viz.:				
Coals, including carriage and dues	1,423,737 19 11	157,171 8 0	444,184 16 9	2,025,094 4 8
Purifying materials, including labour	74,600 3 9	9,262 18 11	22,873 5 10	106,736 8 6
Salaries and wages—manufacture	352,366 9 10	43,646 11 11	114,824 6 1	510,837 7 10
Wear and tear—manufacture	328,332 17 0	29,477 0 1	94,725 10 11	452,535 8 0
Rents, rates, and taxes	162,473 4 3	11,669 16 8	35,655 19 8	209,799 0 7
Salaries—management	17,548 0 5	2,218 16 6	3,775 12 2	23,542 9 1
Collectors' salaries and commission	29,572 10 8	2,983 5 5	9,547 7 6	42,103 3 7
Stationery, printing, and general charges	12,274 7 2	1,992 0 5	9,375 11 9	23,641 19 4
Directors and auditors	5,900 0 0	2,650 0 0	3,725 0 0	12,275 0 0
Salaries and wages, wear and tear—distribution	134,883 4 0	12,434 13 4	51,720 5 2	199,038 2 6
Repair and renewal of meters and stoves	81,322 17 8	4,090 1 6	14,713 2 7	100,126 1 9
Law and parliamentary charges	15,862 13 5	520 13 2	427 0 5	16,810 7 0
Bad debts and extraordinary expenses	39,613 10 5*	2,888 6 8	18,102 7 4†	60,584 4 5
Total expenditure on revenue account	2,678,487 18 6	280,985 12 7	823,650 6 2	3,783,123 17 3
Gross profit	1,037,062 9 3	66,727 7 5	313,625 19 3	1,417,415 15 11
Do. per cent. on capital and borrowed money	8 12 0	7 11 8	9 15 10	8 15 8
Do. do. gas-rental	35 8 4	25 7 9	37 17 9	35 5 5

* Including £19,474 annuities.

† Including £6647 14s. 5d. profit-sharing for twelve months to June 30, 1892.

TABLE *showing the Capital, Income, Expenditure, and Profit, per Ton of Coal carbonized, in* 1892.

—	Chartered.	Commercial.	South Metropolitan.	All the Companies.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Capital and borrowed money	6 1 9·45	3 17 10·68	4 11 2·74	5 10 11·99
Income—viz.:				
Total gas-rental	1 9 6·90	1 3 3·17	1 3 6·92	1 6 7·64
Rental of meters and stoves	9·00	5·86	8·40	8·61
Residual products	7 0·76	6 11·46	7 11·37	7 3·22
Miscellaneous, including old materials	1·65	0·82	1·99	1·67
Total income from all sources	1 17 6·31	1 10 9·31	1 12 4·68	1 15 9·14
Expenditure—viz.:				
Coals, including carriage and dues	14 4·55	13 10·93	12 7·80	13 11·11
Purifying materials, including labour	9·04	9·84	7·82	8·81
Salaries and wages—manufacture	3 6·71	3 10·36	3 3·24	3 6·15
Wear and tear—manufacture	3 3·80	2 7·31	2 8·39	3 1·34
Rents, rates, and taxes	1 7·69	1 0·39	1 0·18	1 5·31
Salaries—management	2·13	2·36	1·29	1·94
Collectors' salaries and commission	3·58	3·17	3·26	3·48
Stationery, printing, and general charges	1·48	2·12	3·20	1·95
Directors and auditors	0·72	2·81	1·28	1·01
Salaries and wages, wear and tear—distribution	1 4·35	1 1·21	1 5·67	1 4·42
Repair and renewal of meters and stoves	9·85	4·34	5·03	8·26
Law and parliamentary charges	1·92	0·55	0·14	1·39
Bad debts and extraordinary expenses	4·80	3·05	6·19	5·00
Total expenditure on revenue account	1 7 0·62	1 4 10·44	1 3 5·49	1 6 0·17
Gross profit	10 5·69	5 10·87	8 11·19	9 8·97

TABLE *showing Increase or Decrease in each Item during* 1892 *compared with* 1891.

—	Chartered.		Commercial.		South Metropolitan.		All the Companies.	
	Inc.	Dec.	Inc.	Dec.	Inc.	Dec.	Inc.	Dec.
	£	£	£	£	£	£	£	£
Capital and borrowed money	263,350	..	35,000	..	107,363	..	405,713	..
Income—viz.:								
Sale of gas by meter	264,381	..	16,768	..	69,890	..	351,039	..
Public lighting, including lighting under contracts	1,108	..	249	..	1,172	..	2,529	..
Rental of meters and stoves	2,812	..	307	..	2,054	..	5,178	..
Residual products	..	230,225	..	21,591	..	13,851	..	265,667
Miscellaneous, including old materials	402	..	164	..	..	306	260	..
Total income from all sources	38,478	..	..	4,103	58,959	..	93,334	..
Expenditure—viz.:								
Coals, including carriage and dues	..	201,094	..	15,576	..	35,889	..	252,059
Purifying materials, including labour	..	9,244	418	..	2,030	..	..	6,796
Salaries and wages—manufacture	..	33,183	..	805	..	3,198	..	37,186
Wear and tear—manufacture	11,139	..	934	..	5,435	..	17,508	..
Rents, rates, and taxes	..	1,144	365	..	..	1,503	..	2,282
Salaries—management	871	..	36	..	..	216	691	..
Collectors' salaries and commission	232	..	70	..	48	..	350	..
Stationery, printing, and general charges	764	..	11	..	664	..	1,439	..
Directors and auditors	..	..	..	..	..	..	..	..
Salaries and wages, wear and tear—distribution	..	3,205	..	757	..	2,347	..	6,309
Repair and renewal of meters and stoves	637	..	78	..	..	146	569	..
Law and parliamentary charges	8,982	..	253	..	..	3,704	5,531	..
Bad debts and extraordinary expenses	689	..	..	272	..	1,827	..	1,410
Total expenditure on revenue account	..	224,556	..	15,245	..	40,153	..	279,954
Gross profit	263,034	..	11,142	..	99,112	..	373,288	..
Do. per cent. on capital and borrowed money	£ 2 0s. 9d.	..	£1 0s. 1d	..	£2 17s. 3d.	..	£2 3s. 0d	..
Do. do. gas-rental	6 7 0	..	2 15 6	..	9 10 10	..	7 15 8	..

NOTES.

Water-Tube Boilers.

There have already appeared some indications that the vogue of water-tube boilers is waning; and this type of steam generators is not likely to be restored to public favour by recent correspondence with regard to them that has appeared in the *Engineer*. One writer on the subject says that he has had charge for a year of a battery of six water-tube boilers, each of a different design, and has had many opportunities of experimenting upon them. He recommends the Knap Improved Root Boiler, with Stolwerck's water heater and purifier, as the type to be selected by any engineer who values his peace of mind. Another writer states that, during the last five years, a number of water-tube boilers have been put down for mills in the Manchester district; but many of them have already been pulled out, having been found to be less economical than the Lancashire boiler. Their chief defects are stated to be their imperfect combustion of bituminous coal, loss of radiated heat from the fire, cost of furnace renewals, and unsteady steam pressure owing to the small content of water. It is admitted that the ordinary water-tube boiler has been fairly successful in London, when expensive smokeless Welsh coal has been used; but even then the cost of keep is reputed to be high. In Lancashire the water-tube boiler as at present made is said to be a proved failure—at least, for mill use.

Wind Pressures on Roofs.

Mr. Henry Adams, M.Inst.C.E., has read a paper before the Society of Architects upon Wind Pressure upon Roofs, which is to a great extent an answer to certain criticisms published in the *Builder* upon the same author's earlier pamphlet on wrought-iron roof design. He then treated wind pressure as a vertical load, taking no account of the horizontal effect. In the later paper, Mr. Adams has gone into the subject generally; and the result is likely to prove useful to engineers having to design structures of any description which are fully exposed to storms. Mr. Adams is expert at simplifying stress computations; and he shows conclusively that, for ordinary straight-rafter roofs, it is sufficiently accurate to consider the wind as producing a vertical load of 30 lbs. per foot super, and much simpler than considering it as blowing horizontally, and calculating in accordance therewith. With arched roofs, however, he regards it of primary consequence to calculate the effect of a wind blowing upon one side only, as the unsymmetrical loading thereby produced will have the effect of reversing the stresses in some of the members, putting some of them into compression which, under symmetrical loading, would be in tension. In concluding his paper, the author, having in view the unsatisfactory condition of the present state of knowledge of wind pressures over large surfaces, directs attention to the importance of an extended investigation of the subject, in a similar manner to the various special investigations which have been made by the Research Committees of the Institution of Mechanical Engineers. With regard to the reduction of wind pressure upon a circular surface to the equivalent plane area, Mr. Adams remarks that Rankine gave the coefficient 0·5 for this purpose; but Mr. R. J. Hutton, in a paper at the Society of Engineers, gave the coefficient 0·67, while Molesworth makes it 0·75. The author's own investigations have led him to think 0·7854 would be nearer the mark.

The Way the Sun Works.

The interesting experiments with low temperatures and high vacua, with which Prof. Dewar has been entertaining the world of science, have had other results than illustrating the possibility of reducing oxygen and nitrogen, and their mixture air, to the liquid and solid forms, which are preserved for a time, under certain conditions, at ordinary atmospheric temperature and pressure. Among other curious questions that have arisen round these remarkable effects, is the old one of the conservation of solar energy. Many philosophers have discussed the manner in which the sun keeps up its radiant powers—including the late Sir W. Siemens, who had a theory on the subject which did not, to say the least of it, command universal acceptance. Up to the present time, the most plausible suggestion upon this head has been that associated with the name of Helmholtz, which, proceeding on the assumption that the sun is constantly losing an enormous amount of energy, only an infinitesimal fraction of which is utilized by the planets of the solar system, accounts for the fact that the stock does not appreciably diminish by supposing that the contraction of the sun's mass has the effect of setting free as much energy as is dispersed by radiation. Even this theory, however, has been regarded with some suspicion, as involving more than one assumption extremely difficult to grasp, and still more to believe. Another idea has now been started, which is based upon the contradictory assumption that the sun does not in reality lose any energy at all in consequence of what we call its radiant effects of light and heat; but that these are only manifestations of something which has no existence outside our perceptions of it. We are now bidden to consider that the idea of a sun spending itself in radiations, of which only an inappreciable fraction could ever be received on all the planets put together, is inconsistent with that we have learnt in regard to other matters of the economy of effort in Nature. These speculations serve to show how little is known of the true nature of cosmic phenomena.

COMMUNICATED ARTICLES.

OXIDE OF IRON: A MONOGRAPH.

By John T. Sheard, F.C.S.

(*Continued from p.* 680.)

Revivifying Oxide in the Purifier.

There are three principal difficulties in the way of revivifying oxide by passing air through it, without removal from the purifier, after the latter has been "turned off." These are, first, the heat produced by the chemical reactions, which, if not regulated, may rise so high as to set fire to the sulphur contained in the oxide, and destroy the wooden grids, or even damage the purifier itself; secondly, the liability of the material to cake or harden; and, thirdly, the offensive odours which are at first given off from the foul material. We may learn from the experience of those who have practised this mode of revivification how these difficulties may be avoided or overcome.

To revivify the oxide in a purifier which has been fouled and is "standing off," there are obviously two methods of introducing the necessary air—viz., by aspirating or exhausting through the material, and by forcing through it. The former method is said to be less likely to cause the material to become unduly heated than the latter.* This may be explained as follows: Aspiration implies that the air current is at a lower pressure than the atmosphere; blowing, that it is at a higher. Thus each cubic foot of air *entering* the exhauster is, in the former case, of less bulk or density (though of the same volume) than in the latter; and therefore the exhauster must move more quickly to pass the same *quantity* of air through the purifier, or, if moving at the same rate, less air is passed through the material during the same time. Aspiration therefore attenuates the air acting upon the material, blowing compresses it; and the quicker the current (that is, the more air employed), the greater is the attenuation in the one case or compression in the other. From these considerations we may expect that acceleration of the air current, while it may increase in both cases the total *quantity* or *amount* of revivification taking place, will in the one case weaken, and in the other (with the limitation hereafter mentioned) strengthen its *intensity*.

Mr. F. G. Dexter, blowing air into an "off" purifier, increased the pressure of air acting on the fouled material by reducing the outlet opening of the purifier, and found that the higher the pressure which he could obtain, the more quickly was revivification effected.† The greater pressure of the air current implied that more oxygen was present in the purifier in a unit of time to act upon the material; thus bringing about more chemical action and evolving more heat in the same time. With air blown into the purifier, it depends, of course, upon the outlet being free or restricted whether the higher pressure shall mean an actually greater quantity of air *entering* the purifier, or merely that the same quantity is being longer retained in it. In either case the purifier contains more air in a unit of time at the high than at the low pressure; but the effect on the revivification process is very different. In the one case the heat produced in the reaction is quickly abstracted; in the other, it is pent up. Thus Mr. Dexter (who restricted the outlet to increase the pressure, his blower being inadequate to provide a greater pressure by means of an increased flow of air) found as the pressure rose the temperature, and also the activity of revivification, rose with it; for a certain elevation of temperature is necessary to enable revivification to take place.‡ But it is conceivable that so much air might be forced into the purifier that the heat would be abstracted at a greater rate than the progress of the chemical action which produced it, and thus an increased air supply would retard or altogether check revivification. Thus, in the course of a discussion on this subject by the New England Association of Gas Engineers. Messrs. Stedman and Allyn stated that they kept the temperature from rising too high by increasing the air supply.§ Experiment in the laboratory confirms the correctness of this procedure. In revivifying a column of fouled oxide by a blast of air, revivification begins in the middle, and reaches last the point where the air impinges on the oxide. An increase in the supply of air, beyond a certain quantity, cools down the mass, and checks revivification. Mr. W. A. Learned remarked, in the course of the discussion just referred to, that he was able to keep the temperature of revivification within bounds by admitting water at the bottom of the purifier; while Mr. W. A. Wood obtained the same result by spraying the oxide at intervals with a jet of water.‖ The last mentioned, though by far the simplest method, and the one most easy of application, is not to be commended, because the wetting of the oxide in this manner must cause it to revivify unequally. Steam admitted in conjunction with the air supply would seem to be preferable.

* See JOURNAL, Vol. LV., p. 691. † *Ibid.*, Vol. LVII., p. 643.

‡ Without any pretence of approach to scientific accuracy, it may be said, in a general way, that, for speedy revivification, the temperature must be allowed to rise so high as to vaporize freely the contained moisture, without the liberation of which revivification cannot proceed. Thus, in blowing through a layer of oxide 12 inches in thickness, I found the temperature rose to 180° Fahr. at the end of half an hour, remaining at that point for another hour, when it gradually receded; complete revivification being effected in from 3½ to 4 hours. About double the theoretical quantity of air required was used in the experiment.

§ See JOURNAL, Vol. LV., p. 691. ‖ *Ibid.*, Vol. LIX., p. 661.

There remains to be considered the caking or hardening of the oxide, which is brought about by this method of revivification, and also the nuisance caused by the offensive gases which are liberated from the fouled oxide on the first application of air. The latter need only be considered when the purifying-house is situated in a thickly-populated neighbourhood; and in that case the gases expelled from the purifier should be passed into a flue, where they can be burnt, or through a small purifier. Mr. Isbell, a member of the New England Association of Gas Engineers, stated in a discussion on the subject that he passed them first through a clean-water scrubber (thereby saving the ammonia), and afterwards through a lime box, before allowing them to go into the air.*

The caking or hardening of the oxide is attributed by Dexter to the absence of moisture, which he proposed to remedy by the admission of steam.† It is, however, to be noted that in a previous paper (already cited) he held that the "soddening effect" of steam, introduced by a steam-jet exhauster, was responsible for the caking of the oxide. Doubtless the improved result recorded by Dexter through the use of steam is attributable to the higher temperature, thereby obtained, facilitating chemical action; while the presence of steam would prevent the temperature rising so high as to fuse the sulphur contained in the oxide. For it seems to me reasonable to suppose that the caking of the oxide is chiefly due to fusion of the contained sulphur, in greater or less extent. When it is considered that this substance melts at 230° Fahr., and that the temperature of the oxide, during revivification, must, as already stated, rise high enough to vapourize the moisture it retains, no great stretch of imagination is needed to suppose that the heat may rise high enough locally to fuse some of the sulphur present. With careful regulation of the temperature (which should not rise higher than 180° Fahr., as indicated by a thermometer inserted in the mass of oxide), there need, however, be very little caking of the oxide. Mr. Wood states (*loc. cit.*) that turning over the material once every five or six revivifications is sufficient to maintain the oxide in a porous condition.

Purification by Oxide with the Admission of Air.

We have seen that the method of admitting a portion of air into the purifier, along with the gas to be purified, was devised by Hills, and patented in 1852. The invention was soon extensively adopted in the gas-works of the Metropolis; but after a time it was gradually discontinued, on account of the difficulty due to an increase of "back-pressure," caused by the caking or hardening of the oxide.‡ To remedy this, Hills invented a purifier with a mechanical arrangement for stirring and loosening the oxide, after it had become hard, without opening the purifier. The arrangement was, however, not a success. He also proposed to reverse the usual course of the gas through the purifier; making it pass through the material downward instead of upwards—an innovation which was adopted at the works of the South Metropolitan Gas Company, and has been continued there ever since.§

After the discontinuance of the London trials, little was heard of the air process until 1880, when (in February of that year) Mr. J. G. Hawkins read a paper on the subject before the Manchester District Institution of Gas Engineers,‖ which excited considerable interest. A further impetus was later on given to the subject by the advocacy it obtained in connection with Cooper's patented coal-liming process, which was introduced in 1882. It was stated that by admitting 1 per cent. of air along with the crude gas (containing less than the usual amount of sulphuretted hydrogen) obtained by the aid of limed coal, an oxide purifier would "run," without changing, for upwards of twelve months, instead of only a week or two as hitherto. When the coal-liming process was discontinued, the employment of air did not cease with it. Further experience of its use had shown that, as the sulphuretted hydrogen increased in amount, the proportion of air employed might also be increased; and instead of 1 or 1½ per cent., as formerly, 2 and even 3½ or 4 per cent. was employed.¶ Of late years, the air process has been more and more resorted to, not only as a means of increasing the efficiency of oxide purification, but also as an aid to the removal of sulphur compounds by means of lime. With this latter application, however, the present article is not concerned.

Effect of Air on the Illuminating Power of Gas.

The objection that has had most weight in deterring gas managers from adopting the air process is the fear of deteriorating the quality of the gas in a much greater degree than could be compensated for by any increase of purifying efficiency. And naturally so. If, as authorities asserted, 1 per cent. of air would reduce the illuminating power of gas by 6 per cent., any possible saving in labour on purification could hardly compensate for the loss. Mr. Henry Aitken found, with gas of 27·8-candle power, that 1 per cent. of air caused a loss of 4·42 per cent. of luminosity;** Mr. B. W. Smith, that 1 per cent. of air reduces 16·6-candle gas by 4·5 per cent.* Mr. Valon states that, with 2½ per cent. of air, each per cent. reduces the illuminating power by 8 or 9 per cent.† Dr. Schilling found that 2 per cent. of air reduced 19-candle gas to the extent of 14·5 per cent.‡; and my own experiments, with gas of about the same quality, have shown a loss 5·8 per cent. for 1 per cent. of air.

If it be advanced, in mitigation of this objection, that the oxygen of the air is absorbed by the oxide, and only the nitrogen remains to go forward with the purified gas, it must still be remembered that the oxygen constitutes only one-fifth of the air, so that four-fifths of the whole must eventually be present in the gas. It has also been shown that the deteriorating effect of nitrogen upon a gas-flame is somewhat greater than that of air; so that, even after the removal of the oxygen, the danger to be apprehended has only been slightly minimized.

Hawkins's Apparatus.

It was with the object of overcoming this serious drawback that Mr. J. G. Hawkins introduced, in 1881, his method of carburetting the air taken into the stream of gas, by first passing it over the surface of tar heated to the boiling-point of benzol. By this means the air was caused to take up from the heated tar sufficient hydrocarbon vapours to neutralize the deleterious influence otherwise exerted by the residual nitrogen. But it has been shown, in many instances, that, where Hawkins's apparatus is not in use, air may be employed to the extent of even 4 per cent. without any diminution of illuminating power being experienced.§ How is this result, apparently so contradictory to what has gone before, to be explained? There are, I believe, two principal causes at work, an explanation of one of which is furnished by Mr. Hawkins himself. Before inventing his carburetting box, he had the air process at work; but he found at first, on drawing in the air at the inlet of the exhauster, that the deleterious effect on the illuminating power was too great to allow of the process being continued. He then tried the effect of (to use his own words) "pulling in the air at different points in the condensers; thinking perhaps it might take up and retain some of the naphtha vapours and light oils so abundant at that point. This," he says, "to my great satisfaction, proved to be the case.‖ Here, then, we have one of the two chief causes why it is possible to admit so much air into the gas being purified without experiencing any deteriorating effect upon the illuminating power.

(*To be continued.*)

* See JOURNAL, Vol. LIX., p. 661. † *Ibid.*, Vol. LIX., p. 1172.
‡ See Mr. G. Livesey; JOURNAL, Vol. XLIV., p. 897. § *Ibid.*
‖ See JOURNAL, Vol. XXXV., p. 408.
¶ See JOURNAL, Vol. LV., p. 287; Vol. LVI., p. 697; and Vol. LIX., p. 485.
** See JOURNAL, Vol. XXXI., p. 802.

COAL GAS: ITS MANUFACTURE, DISTRIBUTION, AND CONSUMPTION.

A Series of Articles for Gas Students.

(*Continued from p.* 635.)

Gasholders and Tanks.

The design and construction of gasholders and their tanks is, in itself, a distinct branch of constructive engineering, and is somewhat beyond the range of a young gas student's studies. It is nevertheless undoubtedly to his advantage to form as thorough an acquaintance as possible with the whole of the plant on his works; and therefore, while special references to underlying principles and data of construction are designedly omitted, as being outside the present scope of these articles, he should find the following descriptive outlines of the modern practice of holder and tank construction to be of service and interest.

Gasholder Tanks.

In form the tank may be annular—a plain circular trench with flat bottom—or, as most usually adopted, a cylindrical well of which a considerable portion of the centre is left undisturbed, and forms what is known as the "dumpling" or "cone." When the accompanying holder has an untrussed roof (described under the heading of "Gasholders"), this dumpling is utilized for supporting timber framing upon which the crown of the holder rests when the latter is empty; otherwise the king-post of the roof trussing will rest on it when the holder is down. The *angle* of the slope of the dumpling will depend upon the nature of the substratum; a firm dry clay or earth allowing a much more rapid slope than would a damp sandy soil. Mr. Newbigging's "Handbook" gives the following as the "angle of repose" of the various earths named:—

Sand, dry	average	37°
Sand, damp	,,	21°
Shingle and gravel	,,	40°
Clay, drained	,,	45°
Clay, wet	,,	16°
Earth, compact	,,	48°
Peat or vegetable earth	,,	28°

The same consideration—*i.e.*, the nature of the substratum—will influence the engineer, almost exclusively, in deciding upon the form of construction to be adopted.

The annular tank is a circular channel lined with inner and outer vertical walls, which are concentric to each other, and also at the bottom. The channel or space comprised by these walls (⌊⌋ in section) constitutes the tank, and contains the water. The top of the inner well and the intervening space is

* See JOURNAL,, Vol. XLVI., p. 604. † *Ibid.*, Vol. LIV., p. 44.
‡ *Ibid.*, Vol. LIX., p. 65. § *Ibid.*, Vol. LV., p. 287.
‖ *Ibid.*, Vol. XXXV., p. 409.

some little distance below the level of the outer wall, and is covered with water to the depth of a few inches. Annular tanks are usually constructed of iron, wrought or cast. As a rule, this form is only adopted where, owing to the nature of the substratum, the depth is necessarily shallow in proportion to the diameter (stated in "King's Treatise on Coal Gas" as being not more than as 1 : 4). With a proportionate increase of depth as compared with the diameter, the surface area of the annular form increases in greater ratio than in the form more generally adopted, and just described.

The materials employed in gasholder tank construction are numerous. They include ordinary brickwork, with or without a backing of well-worked clay puddle; concrete, wholly or in combination with brickwork; stone; brickwork, internally lined with asphalte; cast and wrought iron, &c. The two latter may be used exclusively or in combination with any of the foregoing. In the selection of the material principally to be adopted, the engineer will be guided chiefly by the circumstance already referred to—viz., the nature of the substratum. Other considerations of importance are the local cost of the several materials named, of labour, of transit, of removing the "spoil," &c.

The construction of gasholder tanks often involves great difficulties, which call for the exercise of the highest engineering skill, and may necessitate the adoption of such special means or remedies as will only occur to the minds of men of vast experience, and ready resources of no mean order. These difficulties are so varied and diverse that it is impossible to enumerate them here, or to convey an adequate impression of their nature; but much interesting reading on the subject will be found in most of the annual volumes of Transactions of The Gas Institute, and in the various reports periodically published in the JOURNAL. Under ordinary circumstances, the *modus operandi*, from the setting out of the work to its completion, is somewhat as follows: Prior to commencing the work of excavation—and, as a rule, even before deciding upon the points just considered—viz., the form of tank and the material—it is usual to ascertain, by borings, well-sinking, or other means, the nature of the subsoil. If water should be found in any considerable quantities, adequate provision will have to be made for its continuous removal during the progress of the work. To effect this, there is usually sunk, in close proximity to the tank excavation, a supplementary well, into which the water from the excavation has free access by means of open drain-pipes or otherwise, and from which it is removed by continuous pumping. The well is lowered as the excavation proceeds; being maintained at a depth of some few feet below the level of the latter, in order to keep the workings as thoroughly drained of water as circumstances will permit.

When excavating for tanks of large diameter, it is usual to take out first a circular trench, in which the wall is eventually to be constructed. After this wall is completed, the centre portion and floor of the tank are dealt with. When the work has proceeded to the depth of a few feet, it becomes necessary to support the two sides of the excavation. This is done by shoring; and the extent to which it may be necessary will depend upon the nature of the soil. If it is very loose and shifting, close boarding must be resorted to. In this case each wall or side of the excavation is lined with vertical boards called "poling-boards," which are supported by "walings"—*i.e.*, 3-inch planks placed horizontally along each side of the trench, and jammed and wedged into position by a series of horizontal cross-pieces or "struts," probably 6-inch or 7-inch poles sawn across in lengths equal to the width of the excavation *minus* the combined thickness of the two walings and the poling-boards. As the work proceeds, the latter are periodically driven down with mallets; a mallet-shaped head being loosely fitted on to the top of the board, to prevent its undue destruction during the process of driving. Tier after tier of walings and struts are added as the excavation lowers; and when each poling-board has been driven down its full length, it is followed by another. The distance between the walings and between the struts will depend upon the nature of the ground and the strength of the timber employed. At the necessary intervals in the circumference of the trench, it is widened to allow of the construction of the foundation piers to the gasholder guide-columns. These may or may not be carried up from the bottom of the tank; but provision must, in either case, be made for them in the setting-out and in the excavation. These bays are generally formed square, and are timbered, as is also the supplementary pumping-well, similarly to the tank work proper.

When the bottom has been reached, levelled, and drained (the latter being probably effected by a circular cutting all round the trench, slightly below the tank bottom, and communicating with the before-mentioned well), the foundations are put in, upon which the building of the wall is commenced, and the backing of clay puddle, when employed, well worked in. As this work proceeds, the struts and walings are removed as found necessary, and the earth carefully filled in and well and solidly rammed all round the back of the puddle and wall. The inner ring of poling-boards may be left for removal after the wall is completed. The outer ring will be drawn if circumstances render it expedient, but not otherwise. In the building of the wall, care must be taken that it shall rise simultaneously all round the tank; otherwise the unequal settlement of the various portions of the work may lead to fracture or other damage, and subsequent leakage of water. At the proper intervals, stones are let in for the reception of the holding-in bolts of the tank guides, &c.; also, at the specified level, the foundations for the piers are commenced, and tied in with the rest of the work. These foundations will also embrace the holding-down bolts and the plates of the gasholder columns. When the wall is completed, the centre is taken out, the "dumpling" formed, and the whole floor puddled and paved or otherwise finished according to the specification. On the lower-level portion of the floor will be bedded the rest-stones, upon which the bottom curb of the holder will stand when the latter is empty and at rest.

The foregoing remarks apply more particularly to brick tanks, backed with clay puddle. Ordinary bricks, of good make and shape, will be used and built in English bond, and well grouted with mortar every course. The mortar will be blue lias hydraulic, or Portland cement—the latter preferably. Some tanks are built in hydraulic mortar, and have strengthening-rings let in at intervals in Portland cement. The composition of good hydraulic mortar is one part by measure of the best blue lias lime (freshly slaked), and two parts of clean sharp sand; that of Portland cement mortar being one part of Portland cement to an equal part of sand.* In gasholder work, the practice is to use hydraulic mortar mixed in the proportions just given, and Portland cement mortar composed of one part of cement to two or even three parts of sand.

The foundations will probably be somewhat as follows: Portland cement concrete (consisting of, say, five parts of gravel or broken materials, one and a half parts of clean sharp sand, and one part of Portland cement) projecting from 6 to 12 inches on either side of the brickwork, and varying in thickness according to circumstances. This formula applies only when the sub-soil is such as to provide a good, firm bottom on which to build the foundations. With bad soil, the concrete must be stronger; as, for instance, a case now in mind, where it was found necessary to employ one part each of Portland cement and sand to three parts of hard broken bricks. The concrete is prepared by carefully mixing, in the exact specified proportions, the "aggregate"—*i.e.*, the gravel and sand or broken material—and the "matrix," which is the cement, and turning it over two or three times *in the dry condition;* then slowly and gradually adding water, and turning it over two or three times *in the wet condition*. It is carefully placed in position—*not thrown;* and it may be smoothed over with the back of the shovel).* In very troublesome ground, it may be necessary, in order to ensure a satisfactory foundation, to resort to piling; and it is not at all unusual to specify for timber sleepers upon which the foundation concrete may rest. Two or three courses of "footings" follow the concrete; and on these rise the wall proper. The whole floor is puddled, and not unfrequently a layer of concrete, more or less thick, over the puddle, is specified. The floor is usually paved with stone or bricks set on edge, and grouted with cement mortar.

The tank wall varies in thickness, say, from 4½ to 2½ bricks at the bottom, and from 2½ to 1½ bricks at the top, according to size of tank and other circumstances. The *inner* side of the wall is *perfectly plumb;* and, moreover, it must be *a true circle*. The reduction in thickness is effected by set-offs, at stated heights, on the *outside* of the wall. Wrought-iron bands are sometimes inserted at intervals around the outside of the wall, as a further source of strength. They are tightened up as the work settles. A backing of clay puddle, commencing with the foundations (and possibly from below the concrete), is carried up the whole height of the tank wall; decreasing in thickness as it rises. Clay puddle is prepared for this class of work either by rendering pure clay plastic by thoroughly moistening, cutting, and treading and working with the feet, or by mixing with a small proportion of sand or silt, and treating as just described. It is placed in position behind the brickwork in thin layers, is well trodden in with the feet, carefully backed up with earth, which must be solidly rammed. It must be kept clean from soil and dirt; and the surface should be thoroughly moistened and re-worked before a fresh layer is put in. It is, in fact, essential that the puddle should be kept moist through the whole progress of the work. The top of the wall is usually lined with suitable coping bricks or stones. The piers are capped with stones, which form the bases of the gasholder columns. The holding-down bolts thereto are built in position during the construction of the piers and tank. At their lower end they are secured by holding-down plates built into the pier; and the brick-setter leaves a space 4½ inches square around each bolt, all the way up to the top of the pier. When the column is fixed (the ends of the bolts being passed through corresponding holes in the base-plate) the holes are filled up by pouring in liquid cement, and the bolts are thereby rigidly secured in position.

When the inlet and outlet pipes to the gasholder are not brought through the side of the tank, and carried down a recess formed in the circular wall of the tank (a plan not to be recommended), it is necessary to form a channel for their reception underneath the bottom of the tank. This work falls to the tank contractor; and he has also to provide for bringing them through the bottom of the tank, and to make certain that the work is so executed that there shall be no leakage of water at

* General Scott, R.E.

the point where the pipes come through. When they are conveyed inside the tank in this manner, it is not unusual to make use of the before-mentioned pumping-well for conveying the pipes downwards outside the tank, and from thence underneath the bottom to the inside.

Some tanks are constructed entirely of concrete. When this is the case, similar methods will be adopted with regard to the excavating work, except that the width of the excavation will only be equal to the required thickness of the concrete wall. Wrought-iron bands, varying in width and thickness according to circumstances, are inserted at intervals, and not unfrequently rest on lugs projecting from the outer surface of the concrete. The various stones required are usually natural stone, though concrete blocks are in some cases employed. The inside face of the tank wall, sides, and floor, will be rendered with neat Portland cement from ¾ inch to 1 inch think.

In the building of the concrete wall, which, as with brickwork tanks, is carried up simultaneously all round, every precaution is taken to keep free from dirt the top surface of what concrete is in position, and to ensure its thoroughly uniting with the next layer deposited. Mr. Newbigging, in a very interesting paper on the subject, presented to The Gas Institute in 1890,* described an occasion where a considerable depth of the concrete wall had to be put in in sections, owing to the very dangerous nature of the ground. This, however, was an exceptional case; and exceptional precautions were taken to secure sound and good work.

Mr. King describes tanks constructed in rock (exceedingly porous, however, though free from water), in which he used an outer lining of brickwork, inside which was constructed an inner and similar lining; an annular space 1 inch thick being left between, into which asphalte was poured. This form of construction was maintained in the "dumpling" and floor of the tank. The tank was thus rendered impervious to water by the asphalte, and the latter was protected from injury by the brickwork linings.

Cast-iron tanks are constructed with flanged plates, cast to the requisite radial curve, and provided with all necessary strengthening ribs, and bolted together, and the joints made in iron borings mixed with sulphur and sal ammoniac, well caulked in. Wrought-iron hoops or bands are also provided. Wrought-iron tanks are made with plates riveted together, with a lap which depends, as do also the size and pitch of the rivets, and the thickness of the plates themselves, on the size of the tank.

TECHNICAL RECORD.

NOTES ON THE MANUFACTURE OF GAS.

Paper read by Mr. W. Stagg, of Bristol, before the South-West of England District Association of Gas Managers, April 11, 1893.

The following notes on the manufacture of gas are, to some extent, a record of attempts made to promote efficiency and economy of working. Being at one time worried by the frequency with which the sealing liquid in the hydraulic main was reduced to the point at which gas of abnormally low illuminating power was brought over (no less than thirteen times in one month), I determined to satisfy myself as to the cause. It was suggested to me that this was due either to leaky bridge-valves or to the fact that in some way the tar and liquor syphoned themselves out of the hydraulic main. Neither explanation sufficed for me. The fitful and capricious manner of its occurrence, first in one hydraulic main and then in another, disposed of the theory that it was owing to leaky valves; and a consideration of the facts satisfied me that it was not syphoned out. Close observation convinces me that, in nine cases out of ten, it is attributable to evaporation. I thought perhaps the partial vacuum due to the pull of the exhauster might aggravate the evil; but I am sure this has little to do with it. The boiling-point of tar and liquor is somewhere about 212° Fahr., while the temperature of the gas in the ascension-pipe I found ranged from 120° to beyond 360° Fahr. During the earlier hours of carbonizing a charge, the gas would be *saturated* with vapours; but later on the dry unsaturated gas would certainly tend to diminish the seal. Still this explanation as the active cause breaks down unless it can be shown to occur with some approach to regularity.

To satisfy myself that the reduction of the seal was due to evaporation, I drew some of the hot gas direct from the ascension-pipe through a sample of liquor from the hydraulic main contained in a flask provided with a thermometer. The thermometer registered 104° Fahr. After passing the gas for one hour, I found there was no reduction in the quantity. Thinking this low temperature resulted from atmospheric cooling through the thin glass, I refilled the flask, and inserted it inside the ascension-pipe, and again caused the gas to bubble through in the manner shown on the sketch at A (fig. 1.) In one hour all had disappeared. I withdrew it next time after an exposure of only 10 minutes, with a like result. I then made a similar test on tar. After an hour, 19 per cent. had been vaporized; leaving as a residue a plastic pitchy solid. There is little doubt that much less than an hour would suffice for this result. Then came the question: "Why should the seal be preserved for days and weeks, and then suddenly become reduced?" I purposely lowered the seal in the hydraulic main very slightly on one side only of a bench; taking care to keep it up on the opposite side. In 35 minutes, the temperature of the gas on the lower side rose 180°—viz., from 170° to the limit of the thermometer (350°), which I then removed for fear of fracturing it; while on the side of the normal seal, the temperature steadily fell.

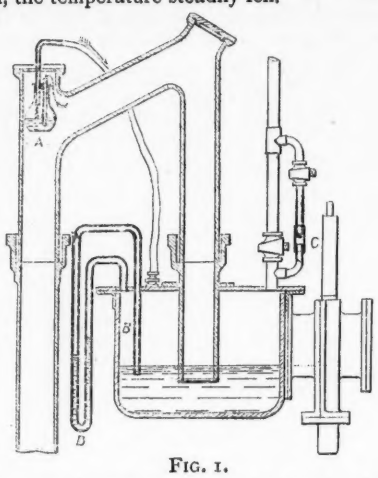


FIG. 1.

Let us suppose that on one side of a bench of retorts you have careful stokers who clear out the ascension-pipes properly after each drawing, but on the opposite side of the same bench you have careless ones who neglect this duty. The bulk of the gas will, of course, take the course of least resistance; and a disproportionate quantity will pass off through the hydraulic main on the side of the clear ascension-pipes. The temperature here will rise correspondingly, and set up a rapid evaporation. Then, having once started to lower the seal, the ratio of the quantity of gas passing on the side of the reduced seal rapidly increases, with a consequent rise in temperature, until the bottom of the dip-pipe is entirely freed by evaporation, and you arrive at the critical point when air and furnace gases are brought over, to the serious detriment of the illuminating power of the gas. I devised a gauge to indicate the approach of this critical point. It is shown at B on the diagram (fig. 1). An ordinary pressure-gauge has one limb connected to the cover of the hydraulic main, while the limb which is usually open to the air is in communication with a pipe passing through the cover of the hydraulic main, and dipping about an inch below the normal level of the seal. While the bottom of this pipe is itself sealed in the liquid, the gauge records the amount of exhaust in the hydraulic main; but should the level of the sealing liquid in the main be lowered, the gauge *gradually* becomes level.

Such a gauge as this would certainly prove useful in small works; but its application is out of the question where there are 20 or 30 hydraulic mains in action. What, then, is the remedy for this "black beast" of the gas manager, which has a knack of turning up at most inopportune moments? An undoubtedly successful remedy is to provide an artificial supply of liquor. For this purpose, a constant stream from a nipple with only ⅛-inch hole is sufficient to compensate for the evaporation in a hydraulic main receiving gas from 40 retorts. Its chief value consists, I think, in preventing the lowering of a seal at its initial stage. I have made a sketch (shown at C, fig. 1) of this arrangement, which provides a 1-inch supply-pipe to refill the main in case of accident. Finding it essential that the tank supplying this liquor service should not be allowed to run out, I have connected an ordinary 24-inch pressure-gauge to the delivery of the pump, to keep the attendant informed; the indicating fluid being mercury instead of water.

I have recently made a number of tests to ascertain what advantage, if any, would accrue from the proposal to remove the tar from the hydraulic main and seal the dip-pipes wholly in liquor. That a liquor seal can be maintained, I have proved beyond doubt, when the syphon for the removal of the tar is used in connection with this continuous liquor supply. With the overflow of the syphon half an inch below the normal level of the seal, it is possible to maintain *continuously* in the hydraulic main a surface layer, four or five inches deep, of liquor unmixed with tar for months together. To ascertain the value of such a seal of liquor over tar, I made some tests upon the illuminating power of gas before and after bubbling through tar and also through liquor. The effect of liquor upon the gas was simply *nil*. The tar, on the contrary, reduced the illuminating power in all cases, until the temperature of the tar was artificially raised to 150° Fahr., when the gas was slightly enriched. This enrichment would be due to the distillation of the richer hydrocarbons, which the tar at lower temperatures absorbed from the gas. In actual working, these illuminants would have been removed to the tar-well during the earlier stage of carbonizing off the charge, and thus lost to the gas.

In seeking for confirmation of the advantage of a liquor seal in practical working, candour compels me to admit that I have found none; although I am certain that the tar has not

*See JOURNAL, Vol. LV., p. 1175.

been within two or three inches of the bottom of the dip-pipe. I had exceptional opportunity for making the test in a setting of eight 20-feet through retorts, carbonizing 8 tons of coal in twenty-four hours, provided with a separate exhauster, purifying plant, and meter. The coal was accurately weighed-in, and a twenty-four hours' test made, first with a liquor seal, then with a seal of ordinary character. The difficulty of being certain that the quality of the coal was the same each day may perhaps introduce an element of uncertainty; but to me it is significant that in all cases the best results were given when working in the ordinary way, with a seal of tar and liquor; and this from each kind of coal and cannel tested upon. It may be alternate tests of twenty-four hours are unsatisfactory. Still, one would think that the retorts having carbonized off four charges for each test, the result would be conclusive.

I should like to say a word in favour of controlling the illuminating power of the gas at the exhauster. A jet photometer, with its own small purifier (standardized *in situ*, once at least every twenty-four hours) connected immediately with the outlet of the exhauster, enables the attendant to observe the earliest possible indication of a change in the quality of the gas coming over, and to deal with it directly and effectively. Barring accidents, it is possible with this arrangement to make gas of approximately constant quality. I am sure it is impossible to over-rate the value of this method from an economical point of view, whether considered from the saving of foreman's time, or in avoiding the waste resulting from making gas of a higher illuminating power than is required. Any lowering of the seal in the hydraulic main is at once observed, by the consequent abnormally low illuminating power indicated; whereas, when the quality is regulated at the end of the process of works' purification, the whole of the plant is filled with gas of low illuminating power before its discovery, and hours of low driving are often required before the gas again attains the standard illuminating power.

It is essential that the jet photometer should record correctly; and frequent adjustment is therefore necessary, to compensate for changes in temperature, atmospheric pressure, and the specific gravity of the gas. Undoubtedly, this adjustment is best done *in situ*, and can be readily accomplished by having a connection made with the gas tested at the bar photometer. I consider the practice of raising or lowering the water-line, in order to standardize the jet, an objectionable one. When the jet photometer registers too low, the hole in the burner can be readily enlarged. Should it, however, be already too large, a difficulty arises. I have tried plaster of Paris for the purpose of reducing the hole, but not with any measure of success. I have sketched an arrangement (fig. 2) which occurred to me, and which has proved most satisfactory. The adjustment is made by raising or lowering a needle placed inside the burner tip. With this method of adjustment, the pointer should always return to zero when the gas is shut off—thus enabling the foreman at all times to check the water-line.

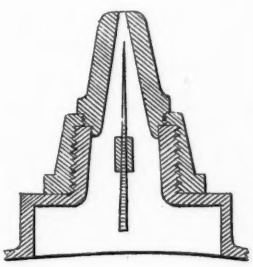


Fig. 2.

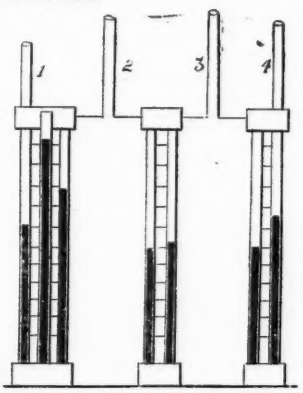


Fig. 3.

1. Inlet to washer. 2. Inlet to scrubber.
3. Inlet to purifiers. 4. Outlet of purifiers

In fixing works' pressure-gauges, as far as possible each should be arranged to indicate to a passing eye the actual *resistance* given. Thus, a washer would be provided with a single gauge combining the inlet and outlet pressures, as is now frequently done with station meters; and the inlet and outlet pressures at the centre-valve thus combined would indicate the total resistance given by a set of purifiers. I believe, with gauges arranged in this manner, a much less frequent booking of pressures will be rendered necessary, the working condition be visible at a glance, and the foreman be set free to give more attention to the paramount duties of the retort-house. I have sketched such an arrangement (fig. 3); and would draw your attention to the left-hand gauge, which has been designed with the object of showing, in addition, the total pressure at the outlet of the exhauster. This appears to me to be necessary, in view of accidentally approaching the maximum pressure covered by the seal in the lutes of purifiers. For myself, I prefer gauges constructed with a sliding scale—the zero being at the bottom of the scale. Having placed this on the lower water-line, the pressure or resistance can be read right off in a straightforward manner.

Let me add a few notes on the use of carburine (sp. gr. 68) as an enriching agent, instead of cannel. After six months' working with one of Mr. Clark's carburettors, without a single failure, I cannot speak too highly of the system. To enrich gas one candle requires 1¾ gallons of carburine per 10,000 cubic feet of gas. The gas carries the carburine perfectly at ordinary temperatures; and there is no deposit even at freezing-point.

A series of tests were made with gas carrying 2¼ gallons per ton of coal, to determine the effect of cold. The carburetted gas was passing for eight hours through a series of U-tubes, immersed first in ice and then in a mixture of ice and salt, giving 20° of frost. As it was necessary that the water vapour present in the gas should be previously removed, calcium chloride was used—this substance having no effect upon the carburine. At freezing-point, the U-tubes were found perfectly dry, after the gas had been passing for eight hours. In the freezing mixture, there was a considerable deposit—probably one-third of the carburine in the gas was thrown down; but, under this condition, common and cannel gas condense out valuable illuminants, so that we are no worse off in this respect than we should be when using cannel. Gas containing carburine is found to absorb naphthalene more readily than common gas; but at freezing point this useful property fails entirely.

A series of tests have shown that the illuminating power of carburetted gas can be recorded perfectly with the jet photometer. The working vapour tension of the carburine is 20 lbs. to the square inch; and ample contact with the heating surface should be allowed, in order to entirely prevent after-deposit. It is surprising how little steam the carburettor uses when it is arranged, as it can be, to discharge only the water of condensation. When managed in this way, the steam gives all its heat.

The question of cost will be determined by local considerations, and practically resolves itself into the difference between the extra cost of cannel over common coal against the cost of the carburine, because the quantity of vapour produced from the latter is not worth consideration. There is, I think, a point of economy in the use of carburine which should not be overlooked—viz., the facility with which the illuminating power of the gas can be maintained at the required standard, without the slightest risk of making and sending out better gas than is actually required. There need be absolutely no waste from this source. Starting with everything cold, four minutes suffice to raise the illuminating power of the gas 1, 2, or 3 candles, as may be required. Only a gas manager can know and feel what a boon this may prove at a critical moment; and I have no need to enlarge before the present company upon the value of such an auxiliary in the manufacture of gas.

Utilization of Coal Shale for Making Water Gas.—At the Mitchell Main Colliery, near Wombwell, a long series of experiments, instituted with the view of utilizing the coal shale which is now unsaleable at the colliery in the production of water gas, recently culminated in some successful trials on a practical scale. They were conducted under the supervision of Mr. F. Scudder, who thoroughly investigated the quantity and quality of both the generator and the water gas resulting from the treatment of the shale. The following results were obtained: The generator gas was found to contain 34 per cent. of combustible gases, and the water gas 92½ per cent.; whereas the gases made from ordinary coke contained only 30 per cent. of combustible gases in the generator gas, and 92 per cent. in the water gas. The volume of the respective gases made was in favour of water gas. The latter will be used in lighting the mine; and arrangements are being made for utilizing the generator gas under the boilers.

Action of Safety-Lamps.—An exhaustive investigation of the behaviour of safety-lamps in mixtures of air with various gases and vapours has been conducted by Messrs. Kämmerer and Oppler, who record their conclusions in the *Journal für Gasbeleuchtung*. The majority of inflammable gases and vapours, when mixed with air in large excess, only cause a lengthening of the flame; but, as the percentage of air decreases, the flame becomes unsettled, and reaches to the top of the lamp. It is then red and smoky; but if the oxygen present is just sufficient to combine with the whole of the inflammable gas, these phenomena rapidly pass away, and the mixture of gases flowing through the meshes of the gauze burns within the lamp. The flame itself is, of course, extinguished by reason of insufficiency of oxygen to support the combustion of the oil. If the inflammable gas is present in excess of the quantity which the oxygen would consume, the burning gases inside the lamp are rapidly extinguished. Hydrogen and Dowson gas act in this manner when mingled with air, as do also alcohol, ether, and benzene in a state of vapour. With a mixture of carbon disulphide and air, the lamps behave differently if the former is present in sufficient quantity to cause any considerable lengthening of the flame. Inflammation ensues within the lamp, and then spreads to the explosive mixture outside; consequently, lamps which are safe in other gaseous mixtures are unsafe in an atmosphere laden with carbon disulphide. One so-called safety-lamp examined was found totally untrustworthy; and the authors therefore recommend that all safety-lamps should be tested by a number of unbiassed observers before being sent out for use.

REGISTER OF PATENTS.

Self-Regulating Apparatus for the Manufacture of Oil Gas.—Lee, J., of Askrigg, and Lancaster, S., of Bainbridge. No. 4922; March 12, 1892.

This invention relates to self-regulating apparatus for the manufacture of oil gas by the action of heat on liquid hydrocarbons of a specific gravity of not less than ·7. In such a machine, the hydrocarbon is in small successive charges conducted to a vessel, in which, by heat, it is entirely raised into vapour. Of the vapour so formed, a part is used to produce, by its combustion, the heat necessary to main ain the working of the machine, and to transform the remainder of the vapour into the permanent oil gas produced by the machine. To obtain the heat for starting the machine, sufficient permanent oil gas is stored in a small holder forming part of its construction. The gas is conducted to a suitable burner in the base of the machine; and, by its combustion, raises sufficient vapour to set the latter in action.

The detailed specification extends to no less than eight printed pages, accompanied by four sheets of drawings, without which the description is not intelligible. The main claims for the invention are: (1) In a machine or apparatus for the production of permanent oil gas, the use of the vapour of hydrocarbon of ·7 specific gravity to produce the required temperature of the dissociator. (2) The use of superheaters for raising the temperature of the hydrocarbon vapour sufficiently to prevent condensation in the length of tube found necessary in the construction of the apparatus. (3) The use in machines designed for the production of permanent oil gas of a permanent gas atmospheric or Bunsen burner, supplied from the holder of the machine, to give the heat necessary to raise the superheaters to the required temperature and to generate vapour in the boiler. (4) The utilization of the waste heat from the vapour burner or the furnace heating the dissociator to continue the heating of the superheaters and the evaporation in the boiler.

Distilling Tar and Analogous Liquids.—Yeadon, J. A., and Adgie, W., of Leeds. No. 5238; March 16, 1892.

This invention is connected with the patentees' previous patent No. 19,183 of 1889. It consists in "the application or combination of the above-mentioned patent for a revolving retort, or any parts of it, for the purpose of distilling tars, oils, and other analogous liquids, either alone or in combination with coal or other analogous materials, and converting such liquids, or liquids mixed with coal or other materials, into gas.

In the patent of 1889, the revolving retort is described as working with fixed and closed gas-tight end-plates or mouthpieces, fitted with suitable packing-rings, for feeding and discharging, by means of which coal is continuously and mechanically fed into and through the retort, where the coal is distilled, the gas generated, and the cinders discharged, without loss of gas or admission of air. In the present invention, it is proposed to use this same principle for distilling tars, either alone or in combination with coal, and converting them into gas for heating or illuminating purposes.

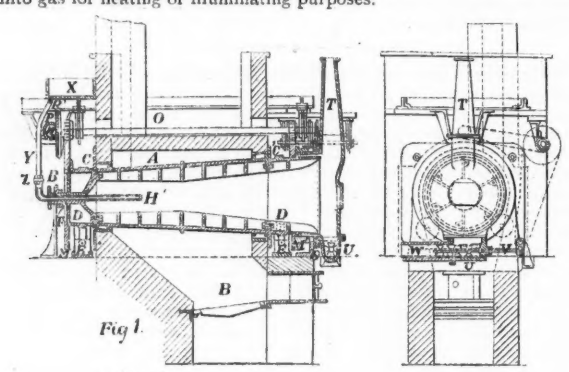


Fig 1.

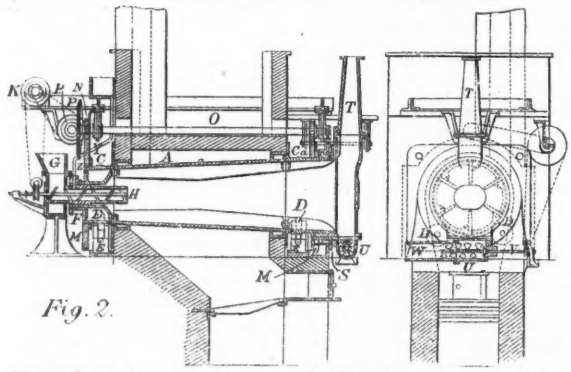


Fig. 2.

Fig. 1 shows the arrangement for distilling the tar alone; and fig. 2 that for the distillation of the tar mixed with the coal.

In the 1889 invention, the coal to be distilled is delivered into a hopper G, from the bottom of which it is conveyed by an internal shaft I, fitted with adjustable blades or worms, through the smaller cylinder H into the interior of the retort A. In the present invention (when the tar is to be mixed and distilled with the coal), the revolving retort, with its continuous feeding motion for the coal, has a pipe Y, leading from an overhead tank or cistern X, containing the tar, and connected to the feed-hopper or worm-box H, through which the coal is delivered into the retort. This feed-pipe is fitted with a tap or valve Z, to regulate the flow of the tar along with the coal into the retort; the arrangement being that the pressure of the tar from the overhead cistern and the working of the internal shaft I fitted with its blades or worms, forces the coal and tar into the retort, and that without escape of gas or ingress of air. Arrived inside the retort, the distillation of the tar and coal is carried out in the same way as in the previous patent. The gas passes up through the ascension-pipe T, while the cinders are delivered into a box U, fitted with an internal shaft V, having adjustable blades, and a tapering outlet-pipe W, by means of which the outlet-pipe is always kept tightly full of cinders, so as to prevent ingress of air or egress of gas—the cinders being delivered, if desired, hot and dry, and the breaking and compressing motion of the adjustable blades reducing the cinders small enough to tightly fill the outlet-pipe. As these adjustable blades and the internal shaft only enter a little way into the outlet-pipe, the effect is that the cinders can only be delivered at the same rate as they fall out of the retort.

As in the previous patent, the body of the retort is supported by two metal sockets C C^1, one at each end, to which it is secured by bolts. These sockets are turned up on the circumference, so that they smoothly revolve on, and are supported underneath by, the turned bearing rollers D, which revolve in the metal frames or boxes E, outside the brickwork of the furnace. The retort is heated by the fire at B, and is fitted with gas-tight glands and boxes at the feeding end F, and at the discharging end S. The feeding-shaft I is driven and regulated by chain-wheels K K^1. Driving motion is attached to the retort by the two spur-wheels M M^1, one at each end; these being fixed on the metal sockets C C^1, and driven by spur pinions N on the horizontal shaft O, which again receives its motion from the bevel-wheels P P^1 through the main driving-shafts.

When, however, tar alone is to be fed into the retort, as shown in fig. 1, the feeding of the coal is unnecessary, and therefore dispensed with. For the internal shaft and blades there is substituted an internal pipe H^1, projecting into the interior of the retort, and connected at the other end to the regulating-valve Z, through the gland and stuffing-box B^{11}. The valve regulates the tar flowing from the overhead cistern through the feed-pipe Y into the retort. The gas as generated passes out of the retort, and through the ascension-pipe T in the ordinary way; and the cinders or ashes produced are discharged through the box U at the outlet W, making a gas-tight joint. Where tar or other liquids are distilled which produce no cinder or ash, the shaft V can be dispensed with, and the outlet W turned down so as to dip into any tank or cistern containing water; thus making a water-sealed joint.

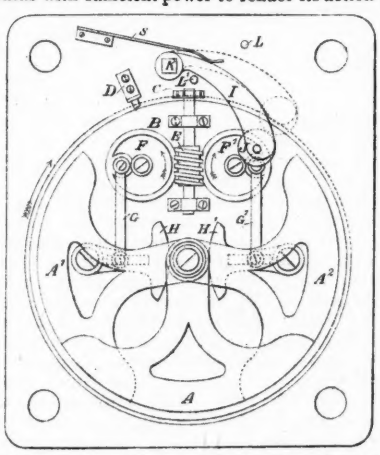
Boring-Machines.—Donkin, E. B., and Bacon, F. H., of Southwark Park Road, Bermondsey. No. 5464; March 19, 1892.

This invention has reference to the construction of a boring-machine designed to enable the casings of gas-exhausters, rotary blowers, and other articles to which it is desired to impart an oval or other non-circular curved form internally, to be accurately bored.

For this purpose each end of the boring-bar is journalled in a bearing arranged to slide transversely in a guide-way formed in a standard or support; and to it are fixed two peculiarly shaped cams, each adapted to work against a roller carried by the standard or support. The arrangement is such that, as the boring-bar is rotated, its axis will be caused (by the action of the cams against the rollers) to reciprocate transversely to such an extent that the point of a boring tool carried by such bar will be caused to travel in an oval or other curved path, and impart a corresponding oval or curved form to the interior of the casing or other article in which it is arranged to work. In order that the rollers may be kept in close contact with their respective cams, one of each pair may be made adjustable in the direction of the cam against which it is to work. The boring-bar can be rotated by a worm-wheel driven by a worm on a driving-shaft mounted in one of the standards or supports, which may be made adjustable in the direction of the axis of the boring-bar, by means of a toothed wheel arranged to gear with a fixed rack, and driven (say) by worm gearing.

Automatically Regulating the Supply of Gas.—Lamb, J., of Middlesbrough. No. 6314; April 1, 1892.

This invention relates to clockwork mechanism for automatically regulating the supply of gas to burners on gas-buoys, and such like situations; its main objects being to provide arrangements for defining and regulating the amount of movement of the gas cock or valve, so as to ensure such movement taking place, and for operating the whole apparatus with sufficient power to render its action reliable.



K is the end of the plug of the gas-cock which is required to be operated; and I is a lever attached to the cock. When the lever is

in the position shown by the full lines, the cock is open; but when it is raised to the position shown by the dotted lines, it is closed, or nearly closed. The extent of movement permitted to the lever is defined by the stop-pins L L^1; and one or both of these pins may be provided with means for adjustment, if desired. B is a circular plate or disc, on which the whole of the mechanism is mounted. The dotted circle indicates a toothed wheel rotated by the clock (not shown) which operates the apparatus. The wheel may be geared with any convenient part of the clock—say, with the fuzee, or main wheel of the clock, either directly or through intermediate gearing, in order to ensure ample driving power. The disc B, carrying the mechanism, rotates with the wheel. Journalled in bearings on the disc is an arbor, having a worm E formed on it, and carrying at its outer end a star-wheel C. D is a fixed tappet or stud, which, as it comes in contact with the teeth of the star-wheel as it passes, causes the wheel to rotate one tooth for each revolution of the disc B. The worm E gears with the worm-wheels F F^1. H is a toothed sector turning on a stud fixed in the disc B; and H^1 is a similar sector. To provide means for adjustment, the pins in the lower ends of the connecting-rods G G^1, are fixed in slots in the sectors, as shown by the dotted lines. A^1 A^2 are sectors with plain curved edges, rotating about the arbor of the disc, and each provided with a pinion on the arbor, gearing respectively with the toothed sectors H and H^1. A is a fixed sector overlapping the lower ends of the sectors A^1 A^2, and thus bridging the gap between their lower ends. J is a roller provided on the end of the lever I.

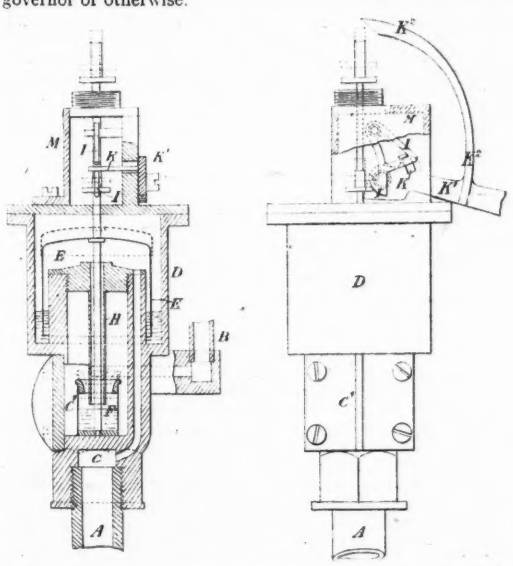
The action of the apparatus is as follows: The disc B is rotated by the clock in the direction shown by the arrow; and the lever I, being in the gap between the upper ends of the sectors A^1 A^2, falls to the position shown by the full lines; and the cock K is therefore open. When the end of the sector A^1 comes in contact with the roller J, the lever I is raised to the dotted position—shutting off the gas supply, partly or wholly, as desired; and the lever is held in this position while the curved edges of A A^1 and A^2 pass under the roller. But as soon as A^2 has completely passed, the lever drops again, and turns on the full supply of gas; the cock remaining open till A^1 again raises the lever. The lever I tends to fall by its own weight; but to render its action positive, it is depressed by a spring S.

Supposing the apparatus to be applied to a gas-buoy, or other device where the gas is required to be turned on full at night, and turned down during the day, matters would be so arranged that the disc B would rotate once in 24 hours; the space between the upper ends of the sectors A^1 A^2 representing the number of hours during which the gas would be turned on full, while the edges of the sectors A A^1 A^2 would represent the number of hours during which it would be turned down. The relation between the lengths of these two times will necessarily vary each day; and the space between the sector ends and the acting length of the sector edge is automatically adjusted each day to the required amount by the star-wheel, worm gearing, toothed sectors and pinions, as before described.

In the case of a gas-buoy, or appliance subjected to movement from waves or other causes, the lever I, unless controlled in the above manner, is liable to have its position continually altered, thereby rendering the apparatus useless; but, by means of these improvements, such objections are said to be overcome. The fact of gearing with the fuzee or main wheel of the clock enables a small clock to be used, while at the same time ample driving power is obtained—a feature of great convenience in the case of gas-buoys or similar apparatus. In such instances, the patentee prefers to employ a clock having no hour or minute wheel, or cannon pinion, but in which the time is denoted by a dial in front of the apparatus, and having 24 hours marked upon it.

Automatic Extinction of Gas-Lights.—Fletcher, A. T., of Leigh. No. 7310; April 16, 1892.

The main object of this invention is to automatically extinguish all the street-lamps or gas-lights in a district at the same time, by means under the control of an official at the gas-works; the principal novel feature of the invention consisting in the utilization, for this purpose, of any increase of the pressure beyond the maximum pressure used for illuminating purposes, so that when it is required to extinguish the lights, all that has to be done is to increase the pressure by means of the governor or otherwise.



As shown in the engraving, the apparatus (which is to be applied to each lamp between the gas-supply pipe A and the outlet B) consists of a small gas chamber, divided by partitions, so as to form an inlet compartment C and an outlet compartment C^1. Above the inlet compartment is a well or cup D, in which is a bell E (sealed by mercury or other fluid, as shown); and from this bell is suspended a valve F, the rod of which passes through a tube into the outlet compartment C^1. This valve is preferably formed in the shape of a cup which surrounds the lower edge of the tube before mentioned, and contains a sufficient quantity of mercury to seal the lower end of the tube when ever the gas-bell rises in the well or cup D, owing to the increased pressure of the gas. On the other hand, whenever the pressure is decreased to or below the maximum point, the bell E would descend and unseal the end of the tube, and let the gas pass from the inlet compartment C into the outlet chamber C^1, and on to the burner tube B. But, in order that this action may not take place after the lights have been put out, and thus cause an escape of gas through the burner, the valve-rod is prolonged above the top of the bell E; and it is provided with a head projection or shoulder, which is automatically caught by a self-acting detent I whenever the bell rises and extinguishes the lights. The bell E and valve F are thus prevented from falling again. To this detent is connected, by a pin or peg K, a small lever K^1, by means of which the lamplighter can at once free the detent by raising the lever, and thus allow the valve F to open when he wishes to relight the lamp. M is a cover enclosing part of the valve-rod G and the detent mechanism. Upon the lever K^1 a projecting arm K^2 is so formed that, when the lever is raised, it will press slightly upon the end of the valve-rod G, and ensure the opening of the valve F.

APPLICATIONS FOR LETTERS PATENT.

6497.—Gill, J., "Fastening or securing doors to gas and other kinds of retorts, refuse destructors, or furnaces." March 28.

6506.—Cross, W., "Anti-dip valves employed in the manufacture of gas." March 28.

6534.—Berk, H., "Gas and oil engines." March 28.

6591.—Thomas, J., "Gas-burners and gas-lamps." March 29.

6639.—Willings, H. C., "Gas and oil stoves for heating and cooking purposes." March 29.

6684.—Muller, H. L., and Adkins, W., "Lighting and extinguishing attachments for electric and gas lamps." March 30.

6724.—Chamberlaine, C. T., and Smethurst, W., "Gas-burner for lighting purposes." March 30.

6735.—Thompson, W. P., "Incandescent gas-lamps." A communication from R. Schlesinger. March 30.

6746.—Fanta, F., "Purifying sewage effluents by means of oxygen, and automatically regulating the flow of gas required." March 30.

6761.—Anstey, W. W., "Gas-brackets." March 30.

6783.—Hardingham, G. G. M., "Air-valve mechanism for water-mains." A communication from C. T. Pollit. March 30.

6900.—M'Caig, W., "Gas-fires." April 4.

6929.—Parker, C., "Gas and oil engines." April 4.

6998.—Dickson, D., and Wilson, J. R. "Heating boilers or vessels by gas or oil flames." April 5

7002.—Schomberg, H., "Combined gas and coke furnace." April 5

7015.—Clark, J. H., "Gas and other burners." April 5.

7059.—Wakeman, G., "Combination gas-stove fire-lighter." April 6.

7064.—Bellamy, A. R., "Gas and similar motor engines." April 6.

7152.—Rose, G., "Self-generating gas or vapour lamps." April 7.

7169.—Ross, R. G., Hilliard, J. B., and Paterson, W., "Directing the passage and controlling the speed of gases, air, or fluids, ascending or passing through fluids or liquids for the purpose of causing absorption of, or otherwise treating such gases, or for sterilizing or otherwise treating the liquids or fluids through which such gases or fluids pass." April 7.

7233.—Smith, J., "Burners for petroleum and other hydrocarbon oils or gases." April 8.

7296.—Kindler, C., "Gas-burners." April 10.

7400.—Higginson, J. H., "Gas regulator or governor." April 11.

7404.—Long, J., "Globes, shades, and other appliances for diffusing and increasing the light arising from electricity, gas, candles, and mineral and other oils." April 11.

7426.—Dawson, H. T., "Gas-engines." April 11.

7455.—Fletcher, B. M., "Fluid-meters." April 12.

7467.—Duff, E. J., "Gas-producers." April 12.

7497.—Edwards, E., "Motive-power engines, actuated by the combustion of a mixture of gas or vapour with air." A communication from P. Hellmich. April 12.

7503.—Doulton, H. L., "Gas-stoves." April 12.

7510.—Taylor, G. H., "Gas-fired boilers." April 12.

7605.—Smith, J., "A retort and apparatus connected therewith for the purpose of converting coal tar into gas for illumination and other purposes." April 14.

7642.—Charter, A. E., "Lighting and extinguishing lamps." April 14.

7688.—Payne, W. S., and James, A. E., "The 'Godiva' gas-engine." April 15.

7717.—Pullen, W., "Oil, spirit, or gas engine." April 15.

7719.—Clarke, A., "A smoothing-iron adapted to be heated internally by gas." April 15.

7723.—Girardet, P. L., "Regenerative lamps." April 15.

New Joint-Stock Companies.—The Watlington and District Gas Company, Limited, has been registered with a capital of £5000, in £5 shares, to supply gas in the parish of Watlington, and, with a view thereto, to carry into effect an agreement made with Mr. J. P. Clarkson for the acquisition of the Watlington Gas-Works. The Humber Lamp Company, Limited, has been formed with a capital of £5000, in £1 shares, to acquire the business now carried on by the Humber Lamp Company at Great Grimsby. The Broadwey and Upwey Water Company, Limited, with a capital of £2000, in £10 shares, has been formed to supply water in the parishes of Broadwey and Upwey, in Dorsetshire, and, with a view thereto, to adopt an agreement, made Oct. 2, 1892, between the Weymouth Water Company of the one part and A. Hallett of the other part.

CORRESPONDENCE.

[We are not responsible for opinions expressed by correspondents.]

Experimenting with a View to the Development of Gasholder Construction.

Sir,—Nothing but good can result from a discussion in which both parties deal fairly with one another. It is therefore a pleasure to me to reply to Mr. Pease's last letter (*ante*, p. 645), and to point out the fallacies underlying it. His letter is a model of what such letters should be.

Taking the points as they arise, Mr. Pease certainly loses sight of the fact that his original article related to gasholders without any guide-framing whatever, and was evidently written to show, not merely "that the sheeting of a gasholder is stronger than it is generally considered to be" (which is a very vague and uncertain declaration), but that *it would be perfectly safe to construct and subject to a wind pressure of 45 lbs per square foot, any gasholder, however large, without any guide-framing whatever, and without any vertical stays or stiffness beyond that derived from the thin sheeting, providing the bottom curb is kept level.* The propositions laid down, and which he considered proved by the experiments, were as follows:—

(1) "That a holder constructed with sides of light material only is strong enough to meet any force to which it will be subjected."
(2) "That if a holder constructed in this manner should collapse, it would be by being blown in on the windward side."
(3) "That the possibility of blowing in a holder in this manner depends on the resistance of the gas inside the holder; and this varies in proportion to the pressure exerted by the holder."
(4) "That any holder constructed of sheet iron (or, what would be better, steel) would have sufficient strength to resist the force [of 45 lbs. per square foot] exerted against it by the wind, unless it were to fail by being blown *in*."

These I proved to be erroneous, and not justified by the experiments. The propositions were not restricted to "inner lifts" of gasholders, but related to the entire holder completely stripped of guide-framing. If the propositions had been narrowed down to the extent now advanced by Mr. Pease, I should not have considered it necessary, in the interests of engineering science, to discuss the subject with him.

Mr. Pease, however, advances yet another new theory—viz., that, in the patented no-guide-framing gasholders, the several lifts forming the gasholder must not be considered as locked together and forming one piece, but are only "linked together," and are free to tilt in one another, and therefore incapable of transmitting any compressive strain down from one to the other (in a vertical direction) without uncupping. Mr. Pease says: "*Where there is no rigid connection between the different parts, it is difficult to see how a moment of compression can exist.*" Just so; but Mr. Pease surely knows that the very essence of the construction of the new non-guide-framing type of gasholders is that each lift is *so locked to the next that it is incapable of tilting*, and forms, when fully inflated (from a structural point of view), one complete cylinder instead of several. Unless Mr. Pease grants this, the main principle underlying all these ingenious inventions is thrown to the winds. If, when the hanging weight is insufficient to overcome the tilting moment due to wind pressure, one lift can tilt in another or open at the cups, without throwing any compression on the lifts below, then the whole gasholder can, on the same principle, tilt in the tank. But we know it to be otherwise. These patented devices are for the purpose of locking and uniting all the lifts, not only to one another, but also to the tank wall, in *one complete cylinder*, so that they shall not tilt or open apart at the cups. Hence, if they yield at all, it must be as a cantilever yields—viz., by the crushing due to compression on one side, or by tension on the other, or by buckling or crippling due to diagonal strains in the sides, or by distortion due to unequal distribution of stress.

We are not dealing with holders constructed on the *ordinary* principle (without patented devices), in which the guide-framing is only *partly* reduced. This has been done long ago; and "the two distinct problems in connection with telescope gasholders" referred to by Mr. Pease were clearly and fully demonstrated in my book on "The Guide-Framing of Gasholders." It is unnecessary, therefore, to do this all over again. We are treating of gasholders entirely divested of guide-framing. Hence, as by the patented devices the several lifts *are* locked together in "one piece," and form one single cantilever, it must be subjected to the laws of mechanics relating to cantilevers. This was done in my calculations of the strains given in my last article. These are correct, and are practically admitted to be so by Mr. Pease, for he says: "If the holder alluded to were all in one piece, it would no doubt be necessary to estimate the overturning moment in accordance with Mr. Cripps's figures."

But Mr. Pease's theory, even if applicable, would not prove his calculations correct, or justify the conclusions drawn from the experiments. Let us assume, for argument's sake, that the five upper lifts are incapable of transmitting any downward pressure on to the sixth or outer lift. Then it will be found that the tilting tendency of the top lifts due to wind (and neglecting snow) would be more than sufficient to open the cup on the side away from the wind, as in fig. 15; and so the entire weight of the outer lift would, according to Mr. Pease, be transferred to O. The actual depressing force due to wind, tending to unlink the lifts on the far side, would be fully 226 tons* (exactly double that stated by Mr. Pease). As this force far exceeds the weight of the outer lift (150 tons) the 5 upper lifts must tilt over as shown in fig. 15. I cannot think anyone would argue that it would be *safe* to throw all the weight of the suspended lifts on to one side of the cup, and concentrate it, or even a good proportion of it, at a single point. It is only necessary to look at Mr. Livesey's 300-feet gasholder, and imagine the outer lift suspended with its entire weight hanging from one point on the circumference, or to fancy the five upper lifts ducked down bodily as in fig. 15, swivelling on a single point of the cup (to ever so slight a degree), to see how unsafe—we might almost say absurd—it would be. Apart from the probable escape of gas, think for a moment of the crushing strain concentrated on the point around which the tilted lifts revolve! I think we may dismiss such a proposition without further comment. Nothing is gained, therefore, in supposing the cantilever as consisting of a series of independent cylinders capable of tilting in one another, instead of being locked together in one piece, as they should be in all gasholders entirely stripped of guide-framing.

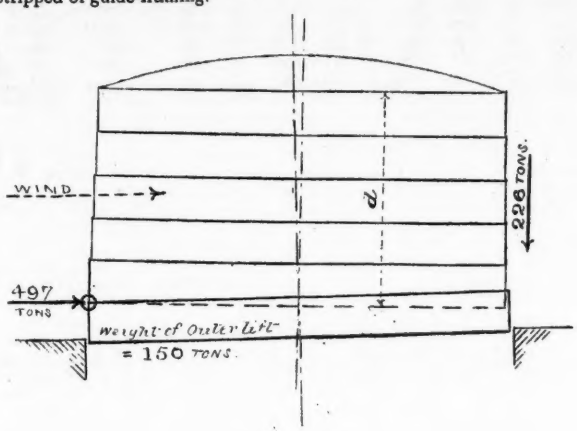


Fig 15.

Hence, if the crushing strain on the sheeting of the outer lift is only to be relieved by permitting the upper lifts to tilt over in the outer one, the remedy would be worse than the disease. But would the crushing strain on the sheeting be so much reduced, even under the above circumstances, as Mr. Pease represents? I think not. When the upper lifts tilt, they cannot support the outer lift on the tilted side; hence the *full weight* of the side sheeting would act downwards upon the bottom curb at this part (just as it did during the erection of the holder). But, *addition* to this, we have the compression induced by the force of 497 tons acting horizontally at O (fig. 15). This adds a vertical compression of fully 75 tons on the same place, besides the greatly increased diagonal strains.

Throughout this discussion, attention has been concentrated almost entirely on the direct vertical compressive force on the side sheeting induced by wind; but to treat fully of the subject of strains on gasholders without guide-framing would cover a much larger field. It would refer to the distorting strains due to the unequal distribution of wind pressure, treated of so admirably by Sir B. Baker in his report on the strains in the large gasholder in the Old Kent Road.* Also the diagonal strains on side sheeting caused by the cylinder being converted into a cantilever by abolishing the usual supports (guide-framing), as well as the *local* strains caused by the nature of the particular device adopted for preserving the various lifts level and locked together.

I think I may claim to have answered Mr. Pease on all the points raised, and established the position I originally took up—viz., that the experiments were inapplicable to gasholders, and the principles deduced erroneous. In reference to the final paragraph in Mr. Pease's letter, I would add that I am very pleased to have been of some service to him in brushing away some of the fallacies (or "falsehoods" is the term I think he uses) from his path. It is not often one's efforts in this direction meet with such courteous acknowledgment, even when the advantage of the discussion is all on one side.

Sutton, Surrey, April 18, 1893. F. S. Cripps.

P.S.—I find that the exact weight of the sides of the outer lift above the bottom curb (including the dip, &c., as Mr. Pease suggests) is only 88 tons—not 136 tons. The weight of the bottom curb and vertical guides is 62 tons. The *total* weight of outer lift is therefore 150 tons. This is verified by the fact that the pressure given by the six lifts when fully inflated is barely 7 inches† (not 12 inches as stated by Mr. Pease), of which 3 inches is given by the inner lift. If we allow 1 inch for the outer lift (which would about correspond with 150 tons), we only leave 3 inches for the remaining four lifts, or ¾ inch each. By substituting 88 tons for 80 tons, and 44 tons for 40 tons, wherever these figures occur in my last article, it will be seen that the conclusions remain unaffected.—F. S. C.

The Position of the Commercial Gas Company.

Sir,—After reading your report of the proceedings at the meeting of the Commercial Gas Company, I can understand your remarks as to the lugubriousness of the Chairman; for the parting with real cash—viz., £45,151—in the payment of dividends might make a Director feel funereal while thinking over the aspect of the finances, as disclosed in the balance-sheet for the half year ended Dec. 31, 1892. You remark that there is nothing specially wrong about the Commercial Company; and in that view you may be strictly correct as regards its financial position. But when the Chairman said they had at one time really earned only practically 6 or 7 per cent., and that they had made up their dividends by taking the money from the reserve of undivided profits, it brings to my mind a railway shareholder's conundrum: "Why is a dividend drawn from the reserve fund like the Mahdi?" Answer: "Because it is a false profit, to be sure." Without accepting the dictum of a riddle as a truism, it would appear that such dividends may deceive investors when the Chairman of a Gas Company proclaims having taken £65,000 of undivided profits and a sum of £5000 from the invested reserve (I do not understand the distinction) in order

* These figures can be proved, if necessary; but the principles are clearly set forth already in "The Guide-Framing of Gasholders," pp. 5-13.

* See Journal for Jan. 25, 1881.

† See appendix to Mr. F. Livesey's paper in the Transactions of the Institution of Gas Engineers for 1892.

to keep up the rate of dividend. The remarks of the Chairman as to gentlemen who spoke at agitation meetings losing sight of the fact "that gas proprietors really obtained very little more than 6 per cent." is beside any question, because directors have simply to think of cash subscribed *re* capital account, in relation to dividends paid out of profit earned; but when dividends are increased out of the reserve fund, such addition ought to be described as "bonus," or by some such distinctive appellation.

I condemn the sliding scale as being a wrong principle to act upon. Consumers of gas cannot be considered in partnership with gas shareholders. I understand a maximum charge for gas, and also a maximum dividend for monopoly undertakings. But a sliding scale is only figuratively practical, because, when it arrives to real business working, then it is found to be devoid of business principle; and I have no doubt in my mind that capital expenditure sometimes increases to benefit the revenue account, and this is bad for the future.

Looking at the balance-sheet, I demur to the wording "By amount invested in Consols." This definiteness might pass in the capital account; and the figures might appear on the trial balance-sheet—*i.e.*, a sheet of balances. But when the adjustment of nominal accounts is made so as to make up the Company's balance-sheet, then an estimated amount should figure as the value; yet such amount should not be in excess of the sum expended. Please note, I do not understand this nicety about "figures to correspond," when everybody knows that buying and selling are two different things. If companies made known the nominal amount of their paper stock investments, shareholders would be given a chance of checking the asset—at its assumed valuation.

April 22, 1893. FACTOTUM.

The Retirement of the Late Mr. Mackenzie.

SIR,—My attention has been drawn to the obituary notice of the late Mr. Mackenzie, of Dunfermline, in the JOURNAL for the 18th inst. The reasons therein given for his retirement are not correctly stated. The fact is, Mr. Mackenzie had for some time contemplated retirement; and the Directors, having resolved to make extensive additions to their works, to which, in his enfeebled health, he was unable to give the attention required, and his son (Mr. John Mackenzie) not having, in the Directors' opinion, sufficient experience in the erection of gas plant to warrant their entrusting the work to his care, it became necessary to appoint a new Manager.

D. ALEXANDER,
Dunfermline, April 21, 1893. Chairman, Dunfermline Gas Company.

Deficiency in the Water Supply of Leicester.—According to a report of the Leicester Corporation Water Department issued last week, there is a deficiency in the Thornton and Bradgate reservoirs, of no less than 159,000,000 gallons. At this time last year, the deficiency was 85,000,000 gallons; so that there is a falling off of 74 millions, or nearly double the deficiency shown at the corresponding date last year. The water has been drawn below weir at Thornton, 2 ft. 6 in., representing 280,000,000 gallons; at Bradgate 2 ft. 10 in., or 450,000,000 gallons. The total thus obtained is 730,000,000 gallons. The capacity of both reservoirs is 889,000,000 gallons. The rainfall for the year, up to date, is as follows: Thornton, March 31, 4·78 in.; Bradgate, March 31, 4·67 in.; and April 17, 0·20 in. During similar periods last year, the rainfall was: Thornton, 3·56 in.; Bradgate, 3·67 in. The water delivered within the limits of supply during March was 106,573,020 gallons; last year in the same period, it was 108,291,760 gallons. The average consumption per head per day has been 17·54 gallons; last year, 18·29 gallons. The water population on the books of the department is 195,960 persons; last year it was 191,740 persons.

North British Water-Gas Syndicate, Limited.—The Secretary of this Company (Mr. J. F. Copeland) has issued to the shareholders a circular dealing with matters which have occurred since they were last addressed by him. He refers to the "mistaken attitude" of the advocates of resistance to the scheme of amalgamation put forward, as under it not only is protracted litigation avoided, but a compromise is effected by which the present liability of £2 per share is reduced to 10s. per share, and the shareholders "retain an interest in the possible ultimate success of the water-gas patents for manufacturing and other purposes." In view of the action of the Committee of the dissentient shareholders, the whole of the facts have been submitted to the Lord Advocate for Scotland (the Right Hon. J. B. Balfour, Q.C., M.P.), who has expressed the opinion that those shareholders are not legally in a position to resist, with a prospect of success, any further call, to obtain an injunction restraining the Directors from parting with moneys now in hand, or to recover the purchase price of the patents. Mr. Copeland points out that this opinion entirely confirms the view held by the Directors; and they have consequently decided to take immediate measures for carrying out the projected amalgamation.

Odessa Water-Works Company, Limited.—The report of the Directors of this Company for the year ended Dec. 31 last, states that the water-rents amounted to £55,961 as compared with £52,952 for 1891; and the miscellaneous receipts, to £3974, against £5186—leaving a balance, after meeting interest on debentures and all charges, including drawn bonds, of £9087, against £12,662. This balance includes the difference on exchange of £165. The Resident Engineer reports that 192 new services were connected and 266 new meters fixed during the year 1892; that the total number of meters in use was 5707; and that the filters, machinery, mains, &c., are all in good working order. With the close of the current year, the period will have arrived when the Municipality will be entitled to exercise their right of pre-emption of the undertaking upon the terms defined by the concession. As the Municipality of St. Petersburg have acquired the works of both the old and new Companies, it is possible that Odessa may determine to follow the same course. The new law affecting municipalities in Russia, which came into force on the 1st of January of the current year, may also have some bearing upon this policy. The Imperial Government now owe for water supplied to the troops £12,296; being an increase of £1087 for the year.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following progress was made with Bills last week:—

Bills read the first time and referred to the Examiners: Altrincham Gas Bill; Barry and Cadoxton Local Board Bill; Brighton and Hove Gas Bill; Devonport Water Bill; East Stonehouse Water Bill; Plymouth Corporation Water Bill; West Hampshire Water Bill.

Bills referred to a Select Committee consisting of Lord Sandford, Chairman; Earl Kingston, Lord Churchill, Lord de Vesci, and Lord Cheylesmore; to meet on Wednesday, April 26: Crystal Palace District Gas Bill, Frimley and Farnborough District Water Bill, and Weaver Navigation Bill.

Petitions against the West Hampshire Water Bill were presented from the Corporation of Christchurch and Colonel Cornwallis West.

HOUSE OF COMMONS.

The following progress was made with Bills last week:—

Bills read a second time and committed: Electric Lighting Provisional Orders (No. 2) Bill; Staines and Egham District Gas Bill.

Bills reported: Dublin Corporation Bill; Wolverhampton Gas Bill.

Bills read the third time and passed: Devonport Water Bill; Dublin Corporation Bill; Stockton-on-Tees Corporation Gas Bill.

The petition of the Swindon New Town Local Board against the New Swindon Gas Bill has been withdrawn.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Thursday, April 20.

(*Before Mr. Justice* NORTH.)

Jones v. Conway and Colwyn Bay Joint Water Board—A Question as to Laying Mains Outside a Water Authority's District.

This was a motion on the part of a landowner to restrain a local Water Authority from entering his land for the purpose of laying water-mains. The Board were constituted by a Provisional Order, duly confirmed by an Act of Parliament which received the Royal Assent on Aug. 5, 1891. The defendants' district consisted of three contributory districts—those of the Conway Urban Sanitary District, the Colwyn Bay Urban Sanitary District, and a portion of the rural sanitary district of the Conway Union. The Joint Board was constituted of representatives of the three districts; and its object was to supply water in bulk to the several Authorities, whose duty it was to distribute it. The plaintiff was tenant for life of certain land situated within the district of the Conway Board of Guardians, but outside the jurisdiction of the Joint Water Board. The question in dispute between the parties depended on the construction of a number of sections of the Public Health Act, 1875. The Board insisted that they had a right to go on the plaintiff's land and lay the mains, subject only to paying compensation, to be afterwards assessed, in the same way that a local sanitary authority has a right to enter on lands within their district for the purpose of sewer construction. The plaintiff, on the other hand, urged that the Board had no such right until the easement had been purchased, or money paid into Court, in accordance with the provisions of the Lands Clauses Consolidation Act; and, in the alternative, he contended that if, on the construction of the Act, the defendants had a right to go on the land to do their work, the work being outside their district, it was necessary that the three months' notice contemplated by section 32 of the Public Health Act should have been previously given, so that the landowner might have the opportunity of getting a Local Government Board inquiry on the subject. It was fully admitted that no such notice had been given. The principal legal points were two. The first was whether, upon the construction of section 54 of the Public Health Act, 1875, the Board were a local authority who could "supply water within their district;" the section giving such authority the same powers, and subjecting them to the same obligations, as a local authority has in respect to making sewers. The other point was whether the effect of the consent of a local authority of an adjoining district, under section 285, to an authority doing acts within the district of the consenting authority is to free the authority to whom such leave is given from the obligation imposed by section 32 to give certain notices before proceeding to execute works outside their district.

Mr. FARWELL, Q.C., and Mr. PATTULLO appeared for the plaintiff; Mr. BYRNE, Q.C., and Mr. ASHTON CROSS represented the Board.

Justice NORTH held that the Board were a local authority supplying water in their district within the meaning of section 54—being constituted for the purpose, and taking steps to do so, though they had not actually supplied any water; and that, consequently, they had the same powers, and were subject to the same restrictions with respect to carrying water-mains within or beyond their district, as a sanitary authority. The consequence of this was that the provisions in the earlier part of the Act with respect to laying sewers applied (*mutatis mutandis*) to the carrying of water-mains by the Board. By virtue of section 16, his Lordship pointed out, the defendants, after giving reasonable notice to the occupier, could go upon land in their district for the purpose of laying mains, and could also, under the latter part of the section, exercise the same power out of their district, subject to the provisions of the Act with respect to sewerage works outside the district. His Lordship next considered section 32 of the Public Health Act, which requires a local authority, before commencing works outside their district, to give

notices, the result of which would be that a landowner would have an opportunity of objecting and bringing the matter before the Local Government Board, and getting an inquiry as to the propriety of the proposed works. It was admitted, his Lordship said, that the provisions of section 32 had not been complied with; and therefore, in his opinion, the Board had no power to enter on the plaintiff's land. It had, however, been argued that the work was intended to be done in an adjoining district, the Local Authority of which had consented to it; and that therefore the Board were in the same position, by virtue of section 285 of the Act, as if the *locus in quo* were in their own district. His Lordship did not read this section so as to cut down the express provision of section 32. He held that the Board had not power to take possession of the plaintiff's land without previously complying with the provisions of section 32; and accordingly he granted an injunction to restrain the defendants from entering the plaintiff's land without complying with the provisions of the Public Health Act.

Electric Lighting for Islington.—The Islington Vestry have unanimously adopted the report of a Committee to put into operation, as soon as possible, the Islington Electric Lighting Order, and establish a central station for the parish, with an installation capable of supplying 20,000 lamps of 8-candle power, and 80 arc lamps for street lighting; and to borrow £60,000 for the required site and plant.

Mexbro' and Swinton Gas Company.—The annual meeting of this Company was held last Thursday. The report submitted by the Directors showed that a profit of £1102 had been made on the year's working, as against £720 at the end of the preceding twelve months. It was agreed that a dividend at the rate of 7 per cent. should be declared, which will necessitate £262 being drawn from the reserve fund.

Georgetown (British Guiana) Gas Company, Limited.—In the report to be presented to the shareholders of this Company at the ordinary general meeting on the 26th prox., the Directors state that the profit for the six months ending Dec. 31 last amounted to £1079. When added to the balance of undivided profit brought forward from the previous half year, and after paying interest upon the debenture bonds, there is an available balance of £1464, out of which they recommend the declaration of a dividend on the preference share capital at the rate of 8 per cent. per annum, and on the ordinary share capital at the rate of 6 per cent. per annum, both less income-tax, except dividends payable to local shareholders. The Engineer and Manager (Mr. T. B. Younger) reports that the works are in good order.

The Electric Lighting of Leicester.—At the meeting of the Gas Committee of the Leicester Corporation last week, the electric light question again occupied attention. Two schemes for lighting a circumscribed area of the borough by means of electricity have been prepared. One of these emanated from the Committee; the other came from outside. The Gas Committee, who have been dealing with the question for a considerable time, have had the outside scheme before them, as well as their own; and we learn that the question of the relative value of the two plans was submitted to an expert, who has now decided in favour of that proposed by the Committee (*ante*, p. 351). Their scheme may now, therefore, be regarded as definitely selected; and there can be no doubt that the Town Council will adopt it.

Bombay Gas Company, Limited.—In the report to be submitted to the shareholders of this Company at the ordinary general meeting on the 4th prox., the Directors state that, although the number of consumers has increased, the receipts for gas and meter-rental in the year ending Dec. 31 last are less than those for the previous twelve months by £1540; considerable economies having been effected by many large consumers in the use of gas, in consequence of the depreciated state of trade, which has been unfavourably affected by the continued decrease in the value of the rupee. The receipts for residual products are less; but this has been to some extent compensated for by the diminished cost of coal carbonized. The returns from fittings exhibit a satisfactory increase; and the activity in this department still continues. The loss by exchange has amounted to £18,704, the whole of which has been charged to revenue. The profit for the year, including the balance brought forward, amounts to £15,710. After deducting the interim dividend (paid in December last), the available balance is £7310; and the Directors recommend a dividend of 3 per cent., free of income-tax—making 6½ per cent. for the year, and leaving a balance of £110 to be carried forward. They regret the necessity for having to propose a smaller dividend than a year ago; but, in view of the uncertainty as to the course of exchange, it has become unavoidable. The contract for the public lamps has been renewed for one year, from the 1st of July next, pending further negotiations.

Rhyl District Water Company.—The annual meeting of the Rhyl District Water Company was held on Thursday last. The report stated that the total amount of expenditure on the works up to Dec. 31 last amounted to £65,242. The gross water-rental for the year was £3925—an increase of £246—and the net earnings were £2917. Dividends of 5 and 6 per cent. per annum on the preference shares and 2¼ per cent. per annum on the ordinary shares were recommended. The report was adopted. The Solicitor of the Company (Mr. Oliver George), in proposing a vote of thanks to the Directors for their past services, said that now the Company was to become a thing of the past, he hoped the Rhyl Commissioners, who had taken over the undertaking, would give in the future as much satisfaction to the water consumers as the Company had done. He considered the Commissioners had every reason to be satisfied with the bargain they had made. The motion having been carried, the Chairman said that the final distribution of the money could not be made until the liabilities of the Company had been discharged; and on behalf of the Directors he moved a resolution authorizing the Directors to pay off the debentures, and to take proceedings for winding up the Company. This was agreed to. Attention was called by a shareholder to the position of the Secretary and Manager (Mr. Bayliss), who is now close upon 70 years of age; and the opinion was expressed that a sum of money should be set aside for the purpose of purchasing for him an annuity. The Chairman said the Directors fully appreciated the services which had been rendered to the Company by Mr. Bayliss; and they had the matter referred to now under consideration.

MISCELLANEOUS NEWS.

OPENING OF NEW GAS-WORKS FOR RUSHDEN AND HIGHAM FERRERS.

Last Tuesday, the new works erected to supply gas to the rapidly extending district of Rushden and Higham Ferrers—in the very centre of the now prosperous bootmaking industry of Northamptonshire—were formally opened in the presence of a large number of gentlemen representative of the Gas Company and the towns and surrounding district. The Chairman of the Company (Mr. John Spencer) turned on the valves connecting the gasholder with the trunk mains; and in a few appropriate words expressed the pleasure it afforded him to inaugurate the supply of gas from the new works, and his anticipations for a prosperous future for the concern. Subsequently, a large party sat down to dinner in the show-room attached to the new offices. At its close, a short toast-list was gone through; the principal toast—"Success to the Rushden and Higham Ferrers Gas Company, Limited"—being cordially proposed by Mr. W. Woolston, the Chairman of the Wellingborough Gas Company, whose Engineer and Manager (Mr. J. T. Lewis) designed and superintended the carrying out of the works just opened, which will be under the management of his father, Mr. John Lewis, sen. Mr. G. S. Mason is the Secretary of the Company.

A brief account of the Company may not be uninteresting. It was incorporated on Feb. 12, 1892, to supply gas to the towns of Rushden and Higham Ferrers, which up to that time had been supplied by two separate concerns—the Rushden Gas and Coke Company and the Higham Ferrers Gas and Coke Company. The Higham Ferrers Company was first in the field; having been formed in the year 1855, with a capital of £1500, in 150 shares of £10 each. At that time the inhabitants of the ancient borough numbered 1100; but a much larger trade was being done in the town than its population would lead a stranger to suppose. Higham Ferrers was then a very important centre of the Army shoe trade; large numbers of the residents in the surrounding villages being employed by the firms of the town in the production of boots and shoes in their own houses. The gas-works were erected by Mr. George Bower, of St. Neots; and, under good management, the Company became very prosperous. For many years, dividends of 10 per cent. were paid; the shares being considered one of the best investments in the district—realizing from £14 to £15 when sold. In 1873, Mr. Lewis, who had been Manager of the works from the commencement, accepted an offer from the Rushden Gas Company to take charge of their works. Unhappily, however, for the Higham Ferrers Company, this change proved the turning-point of its fortunes—the dividends decreasing until they became *nil*.

The Rushden Gas and Coke Company was formed in 1864 to supply gas to the parish of Rushden. The works were erected under the superintendence of Mr. John Eunson, the Engineer of the Northampton Gas Company. Rushden was then a growing village, with a population of 1900, also chiefly engaged in the shoe trade. The Company, in the early years of its existence, had some difficulty in keeping its head above water; but in 1873 the Company secured the services of the Higham Ferrers Manager (Mr. Lewis), and from that time the fortunes of the Company improved. A dividend of 10 per cent. was for many years paid on the Company's shares. The population and trade increasing very rapidly, the Company extended their works to meet the increased demand for gas—paying for all extensions out of revenue; and to recoup the investors for their early disappointments, 160 additional shares of £2 10s. each were created, and given to the shareholders (the previous capital being 160 shares of £10 each). A sum of £400 was transferred for this purpose from the reserve fund to capital account. So valuable did the Company's shares become, that as much as £24 has been paid for them. Owing to repeated extensions, the site of the works became too cramped for any further extensions to take place; and the Company were advised to try and secure a fresh site near the branch railway that the Midland Railway Company were then starting to construct. As the Engineer was also consulted by the Higham Ferrers Company, he advised them, if possible, to amalgamate with the Rushden Company, and erect a new combined works for both towns.

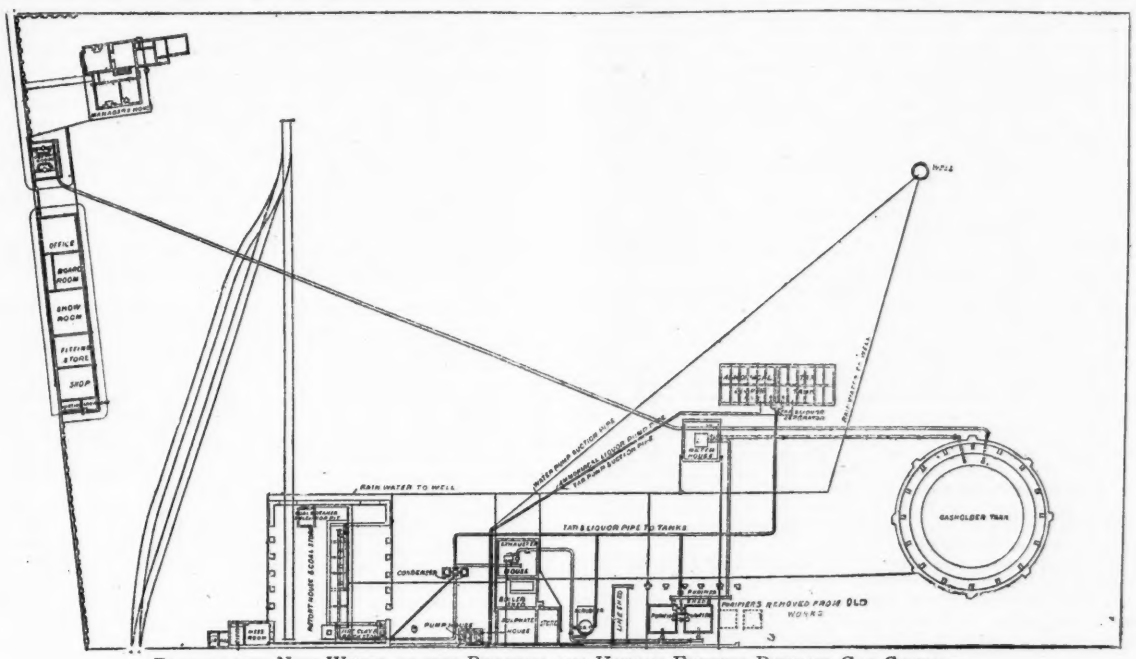
After overcoming some opposition to the scheme, Mr. Lewis was able to persuade the shareholders of the two Companies to agree to the scheme of uniting to form a new Company; but some delay took place, as the Local Board of Rushden approached the Rushden Company to see if they would not dispose of the undertaking to their Board. The Company were quite willing to sell their works by valuation; but, after some stormy meetings, a poll of the ratepayers was taken, and they rejected the proposal to buy. Upon this result becoming known, the two Companies held the necessary statutory meetings, and decided to voluntarily wind up the concerns. Mr. E. B. Randall, of Higham Ferrers, was appointed Liquidator of the Higham Company; and Mr. W. H. Wilkins, of the Rushden Company. As soon as this was done, the formation of the new Company took place, under the title of the "Rushden and Higham Ferrers District Gas Company, Limited," with a capital of £10,000, in 1000 shares of £10 each. The Directors of the old Rushden and Higham Ferrers Companies formed the first Directors of the new Company. The proprietors of the two undertakings were offered shares in the new Company at the following rate: The Higham Ferrers shareholders, one £5 share in the new Company for every two £10 shares in the old one; and the shareholders of the Rushden Company, four £5 shares for every share of £12 10s. in the old Company. With one exception, they all decided to have shares in the new Company, which took over all assets and liabilities of the old concerns.

By the Company's Articles of Association, it is provided that, whenever the dividend to be paid to the members exceeds £5 per cent. per annum, such members as are consumers of gas supplied by the Company shall be entitled, in addition to their dividend, to a bonus on a maximum yearly consumption of 10,000 cubic feet for each £5 of

share capital held by them—after the rate of 1d. per 1000 feet of gas consumed by them for each 1 per cent. per annum of dividend declared above 5 per cent., but that in no case shall the bonus exceed 5d. per 1000 feet of gas. The object of this is to secure the interest of the consumers; and the result was that when the shares were offered to the public, three times the number to be allotted were applied for—the majority of the consumers being thus shareholders in the concern.

The Company secured for their new works a very eligible site of 5 acres adjoining the branch line of the Midland Company; and they commenced operations with the construction of the gasholder tank in March of last year. Besides the ordinary works, the Company had to make a road, about 150 yards long, from North Street to their entrance gates. In addition to the construction of the works, the Company have laid a new 12-inch main to the centre of Rushden and an 8-inch main to Higham Ferrers.

The united population of the two towns is something like 11,000; and the gas consumption is at present about 16 millions. The price charged is 4s. per 1000 cubic feet, less 2d. discount to ordinary consumers, and an additional discount of 6d. per 1000 feet for all gas used by gas-engines and cooking-stoves supplied through separate meters. The Midland Railway Company have entered into an agreement with the Company to construct a siding into the gas-works; and as the cartage is now at the rate of 1s. 9d. per ton into the works from the Midland Company's station at Irchester, a considerable saving will be effected when the siding is constructed. By the amalgamation with Rushden, the Higham Ferrers consumers at once had the price reduced 10d. per 1000 feet—from 4s. 8d. to 3s. 10d. net.



PLAN OF THE NEW WORKS OF THE RUSHDEN AND HIGHAM FERRERS DISTRICT GAS COMPANY.

Description of the Works.

The general arrangement of the works is shown in the above plan.

The retort-house is of the stage-floor type; its internal dimensions being 79 ft. 2 in. by 64 ft. 3 in. The walls for the first 7 ft. 9 in. above the concrete foundation are 3½ bricks (2 ft. 7½ in.) thick; the next 6 ft. 3 in., 3 bricks (2 ft. 3 in.) thick; the next 20 ft. 3 in., 2½ bricks (1 ft. 10½ in.) thick, except in panels, where the thickness of the walls is 1½ bricks—making a total height of 34 ft. 3 in. to the eaves. The gable ends rise 16 ft. 6 in., with a thickness of 1½ bricks (1 ft. 2 in.). The stage-floor line is 9 ft. 6 in. above the ground-line. The front line of the retort-bench is 22 feet from the inside of the front wall—the bench being 12 ft. 3 in. from back to front; leaving a space of 30 feet for the coal-shed. There are two doorways 10 feet wide in the west end of the retort-house—one opening into the retort-house proper, and one into the coal-shed. The space below the stage in front of the retort-bench forms the clinkering-floor and the coke-store. At the end nearest the chimney is a space partitioned off for the purpose of forming a fire clay and brick store. The chimney-stack has a flue 2 ft. 3 in. square. The base of the chimney is 8 ft. 4 in. square and 4 ft. 6 in. deep (standing on a concrete foundation); for the next 5 ft. 3 in. the walls are 2 ft. 3 in., set off to 1 ft. 10½ in. for 10 feet, to 1 ft. 6 in. for 12 ft. 9 in., to 1 ft. 2 in. for 13 ft. 3 in., and to 9 in. for 11 ft. 10 in., with a cornice 2 ft. 7 in. deep round the top—making a total height of 60 ft. 2 in. from the ground line. A flue 2 ft. 3 in. by 2 ft. 9 in. extends the whole length of the retort-house. The roof is wrought iron, trussed and slated, with a louvre ventilator extending the greater part of the length of the house. The roof principals are placed 9 ft. 9 in. centre to centre. The retort-bench is 60 feet long, extending from the base of the chimney to the further end of the house. It consists of six arches for settings of retorts 8 feet wide, with division walls 18 inches thick. The height of the bench from the ground line to the springing of the arch is 13 ft. 9 in., with a rise of arch of 3 ft. 9 in. The arches are built in three 4½-inch rings. The total height of the bench is 19 ft. 9 in. Each setting consists of six ⌂ retorts 22 in. by 16 in. by 10 ft., set in the arch; the bottom of the two lower ones being 1 foot above the stage-floor line. These retorts are heated by means of a furnace working on the generator system; its floor-line being 3 ft. 6 in. above the ground-line. The secondary air supply is heated by means of flues which pass backwards and forwards by the side of the furnace, and between that and the flues which carry off the waste gases to the main flue. Each setting is fitted with a separate section of hydraulic main, so that when a bed of retorts is let down it can be altogether shut off from the rest; reducing the risk of drawing in air very considerably. At one end of the retort-house is the men's mess-room and lavatory, &c.

The condensers stand on two square brickwork bases 9 ft. 7½ in. from centre to centre, which are 4 ft. 9 in. by 4 ft. 9 in. by 1 ft. 9 in. built on concrete foundations 6 ft. 9 in. by 6 ft. 9 in. by 4 ft.; and surmounted by a stone cap 6 inches thick, chamfered off on three sides, with a square hole in the centre, and an air-flue in the brickwork fitted with grid-valve for the purpose of regulating the supply of air to the centre of the condensers. They are of annular pattern, 24 feet high, with the outer tube 3 feet, and the inner tube 2 feet in diameter, with an arrangement of valves by means of which either one or both of them may be used.

The exhauster-house is 22 ft. by 20 ft. internal dimensions, with 14-inch walls 15 ft. 6 in. high from the floor-line to the under side of the stone template for the roof principal; and from that point the roof rises 7 ft. 6 in., not including the louvre ventilator, which is placed over the centre of the room. The exhauster is a 20,000 cubic feet per hour one, of the combined rotary type, with engine, fitted with two 8-inch disc-valves and one 12-inch full-way bye-pass valve, with compensating arrangement and governor to work them. The engine will be controlled by another governor acting on the throttle-valve of the steam-pipe; making its action automatic as far as can possibly be done. The 5000 cubic feet rotary exhauster is to be removed from the old works and fixed in the new ones.

The boiler-shed is 17 ft. by 23 ft. 2 in., with walls 15 ft. 9 in. high to the stone template. The front is open the full width, and to a height of 12 feet. The wall over the opening is supported on two 9 in. by 6 in. joists. The boiler is of the Cornish pattern, 13 feet long and 5 feet in diameter, with an internal flue 2 ft. 6 in. in diameter. It is made of wrought mild steel. The shell-plates are ⅜ inch thick; the flue-plate, ⅜ inch, flanged, with a ring 3 ft. by ½ in. between the flanges. In the back flue-plates are fixed two Galloway tubes. The end plates are $\frac{7}{16}$ inch thick. The boiler has been tested to a pressure of 120 lbs. per square inch. The valves are set to work at 40 lbs.

The composite trussed roofs to both the exhauster-house and the boiler-shed are covered with 20 in. by 10 in. slates.

The sulphate-house is 22 ft. by 20 ft., with 14-inch walls, 15 ft. 9 in. high to the template. The rise of the composite trussed roof is 7 feet high. The sulphate-store, 12 ft. by 20 ft., with 14-inch walls 9 ft. 6 in. to the template (outer wall); the lean-to roof rising 7 ft. 3 in. (The sulphate plant is not yet erected.)

The purifier-shed is 69 ft. 5 in. long and 32 ft. wide (internal dimensions), with 14-inch walls 15 ft. 9 in. high; the back and side wall enclosing the lime-shed. The front wall consists of 10 feet of 14-inch work (forming lime-shed); the remainder consisting of 18 in. by 14 in. piers at 10-feet centres, with a 9-inch projection inside to give greater bearing for the roof principals. There are two purifiers, 15 feet square, worked with six 12-inch valves, to be supplemented by two others, 9 ft. by 9 ft. by 4 ft., removed from the old works. The scrubber stands on a base 16 ft. 3 in. by 9 ft. 10 in. by 2 ft., semicircular at one end. It is 8 feet in diameter and 55 feet high (internal dimensions); and it will pass 250,000 cubic feet of gas per day. It is fitted with boards, and has a water-distributor fixed on the top, three 12-inch valves and connections to form a bye-pass, machinery-room, with balcony, and a spiral staircase leading to the top.

The meter-house is 19 ft. 3 in. by 20 ft. 9 in. internal dimensions, with 14-inch walls, 15 ft. 3 in. high to the template, from which the rise of the roof is 7 feet (5 ft. 7 in. from the eaves to the ridge). The meter base is a 7 ft. 6 in. hollow square of 9-inch brickwork, filled with concrete 4 ft. 4 in. high, on a foundation of concrete 9 ft. 6 in. and 18 inches thick, covered with stone caps 4 inches thick. The meter is capable

of passing 15,000 cubic feet of gas per hour. It is fitted in a cast-iron circular case, and is fixed on the base, with bye-pass connections.

The pump-house is 11 ft. 6 in. by 8 ft. 6 in. (internal dimensions). The back and front walls for a height of 12 feet consist of 14-inch work; above that height, of 9-inch work. The side walls are 18-inch work, with two 9-inch piers on each side, continued up to a height of 12 feet from the floor-line to form a bearing for the joists supporting the tar and liquor tanks. The total height of the walls is 19 feet; and on the top is a water-tank 15 ft. 6 in. by 11 ft. 9 in. by 2 ft. 6 in., forming also the roof of the house. The tar and liquor tank is 7 feet square and 4 ft. 6 in. deep, divided by a plate in the middle to form the two tanks. The pumps consist of three steam double-acting piston pumps, one of which is used to pump the water from the well to the tank for the supply of the works; the other two for tar and liquor.

There are two tanks for tar and liquor, each 30 ft. by 20 ft., divided from each other by two 9-inch walls, with a space of 6 inches filled in with cement concrete. The outer walls consist of two 9-inch walls, with a 3-inch space filled in with fine cement concrete. The bottom of the tanks consists of a 6-inch layer of fine cement concrete. In the centre of each tank is an 18-inch pier to support the steel girder, 15⅜ in. by 6 $\frac{3}{32}$ in. by 32 ft., which runs longitudinally down the centre of each tank. Cross joists are placed at 5-feet centres across the tank. These joists are 12 in. by 5 in. by 22 ft. The concrete covering of the tank is 12 inches thick. The depth of the tank from the bottom of the 15⅜-inch girder to the bottom of the tank is 10 ft. 8¾ in. A manhole 2 ft. by 2 ft. 6 in. is fitted to each tank. The combined tar and liquor is collected at the various apparatus, and brought by means of pipes to a separator, which is placed in a line with the centre division of the tanks, and in which the tar and liquor are separated, and passed to their respective tanks.

The gasholder tank is 84 feet in diameter and 27 ft. 3 in. deep from the top of the coping to the concreted bottom. The bottom consists of 12-inch concrete, except round and on the top of the dumpling, where it is reduced to 6 inches. The walls consist of 13½ inches of footings, then 8 feet of work three bricks thick, reduced to 2½ bricks for the next 9 feet, and to two bricks thick for the remaining 9 ft. 1½ in. The coping consists of best blue bricks. Round the tank are built, at equal distances, twelve piers 3 ft. 9 in. deep from back to front, and 3 feet wide at back. There are 24 rest-blocks 3 ft. by 18 in. by 13½ in. placed equidistant round the tank. Where the tank walls project above the clay in which they are partially built, they were backed up with 18-inch puddle before the ground was made up to them. A pier 2 ft. 3 in. square and 8 ft. high is built in the centre of the tank on a concrete base 3 ft. 3 in. square by 2 ft. 6 in. deep, to take the weight of the crown when the holder is down.

The gasholder is of the telescopic pattern, in two lifts; the outer one being 82 feet in inside diameter and 26 feet deep, the inner one 80 feet in diameter and 26 feet deep. The crown of the holder rises 4 feet in the centre. It is strongly trussed, and the sides firmly stayed. The guide-framing consists of 12 wrought-iron lattice standards, 3 feet at the base, tapering to 1 ft. 6 in. at the top, and being 54 ft. 6 in. high. At a height of 24 ft. 9 in., the standards are connected with each other by means of lattice girders 2 feet deep at the ends, and 1 foot in the centre; and the same thing is done at a height of 49 ft. 9 in. The inlet-pipe is 10 inches, and the outlet-pipe 12 inches in diameter; the valves for closing the same being placed in the meter-house. The cup is provided with an arrangement for preventing the water freezing.

West's drawing and charging machinery has been adopted in the works. At one end of the retort-house is placed a combined engine and coal-breaker, with elevator. This machine breaks the coal, and then elevates it to a fixed hopper placed 18 feet above the stage-floor line. From this hopper coal is supplied to a smaller travelling hopper fixed over the charging-machine, which it supplies. Both the drawing and charging machines have gear for adjusting them to the height of the three tiers of retorts. The coke as drawn falls down immediately below the stage-floor to the coke-store, where it is quenched and stacked. From the holder the gas is carried to the governors by a 15-inch main, and is there distributed through two of Cowan's patent governors—one for the 12-inch main to Rushden, the other for the 8-inch main to Higham Ferrers. The internal dimensions of the governor-house are 15 ft. by 20 ft., with 14-inch walls 15 ft. 6 in. high to the eaves.

The block of buildings comprising the office, &c., is 113 feet long and 22 ft. 4 in. wide, and is divided as follows (internal dimensions): Office, 20 ft. by 20 ft.; board-room, 20 ft. by 15 ft. 6 in.; show-room, 30 ft. by 20 ft.; fittings stores, 18 ft. by 20 ft.; shop, 18 ft. by 20 ft.; building for hot-water heating apparatus 6 ft. by 11 ft. 3 in.; and lavatories, &c., 6 ft. by 8 ft. The outer walls are 14 inches thick, and the division walls are 9-inch work. From the office to the show-room runs a passage 3 ft. 9 in. wide, which takes off slightly from the size of the board-room. There is in each room a door opening directly to the outside; and all the rooms, with the exception of the shop, can be reached from the office without going into the open air. The shop, fittings stores, and show-room are heated by means of hot-water pipes round one or more sides; the board-room being heated by one, and the office by two coil radiators of the latest design.

The whole of the brickwork has been carried out by Mr. G. Henson, of Wellingborough. The coal breaker, elevator, hydraulic mains, and retort fittings, and charging and drawing machinery were supplied by West s Gas Improvement Company, Limited; the retort-house roof, condensers, pumps, tanks, boiler, exhauster, scrubber, purifiers, gasholder, and connections, by Messrs. R. and J. Dempster; the station meter, by Messrs. Milne, Sons, and Macfie; and the governors, by Messrs. W. and B. Cowan. All the contracts have been completed to the entire satisfaction of the Company's Engineer. The total outlay on the works, including land, siding, and mains, will be about £16,000.

A Water Scheme for Rugeley.—Mr. R. Walton has recently held an inquiry at Rugeley respecting an application by the Local Authority to the Local Government Board for sanction to borrow £5750 for carrying out a project for supplying the town with water. It was stated that Professor Boyd Dawkins had reported in favour of a site at Fair Oak; a number of trial borings having proved that an ample supply of pure water could be obtained there.

MR. F. T. C. LINTON ON OIL-GAS PROCESSES.

A report by Mr. F. T. C. Linton, Engineer of the Leith works of the Edinburgh and Leith Gas Commission, on "The Manufacture of Gas from Oil," was submitted to a Committee of the Commissioners last Thursday. We are able, through the favour of a member of the Commission, to give the principal portions of the document:—

I had an opportunity last year of inspecting the various processes for the manufacture of gas from oil in course of being experimented with at several of the gas-works in London; and I have also had full information regarding these processes. I have further had an opportunity this year of carefully inspecting the process invented by Mr. Wm. Young, which has been in operation for some time at the Peebles Gas-Works. As sanctioned by the Sub-Committee of the Commissioners, Mr. Walker, Assistant-Engineer at Leith, was also sent to Peebles for three days (accompanied by the assistant at the Edinburgh works), and made careful notes of the apparatus and methods of working, the quantities of materials used, and the quantity and quality of the gas obtained, &c.; and the results of the notes are embodied in the information given in the appendix to this report. There is also given a statement of the working results at the Peebles Gas-Works for the months of November, December, and January last; and, as these are fully borne out by those arrived at by ourselves, they can evidently be depended upon as being about correct. I have also had an opportunity this week of seeing the Alexander-Paterson process of the Patent Paraffin Gas Lighting Company of Glasgow; and notes regarding it are also given in the appendix.

The various processes hitherto in use for the gasification of mineral oils may be conveniently classified under one or other of the following heads:—

(1) Those in which the oil is dealt with at one operation by being run into a retort maintained at a temperature of not less than 1500° to 1600° Fahr. Pintsch's system may be taken as an illustration of this class, where the products per gallon of oil are about 80 cubic feet of gas of 60-candle power, with a quantity of thin black tar, and a small amount of carbon deposited in the retort. The gas is permanent in character, and withstands compression well; hence its use for the lighting of railway carriages. It is found, however, that the process requires oil of a comparatively low specific gravity (·840 to ·850), as whenever heavier oils are used, the retorts and apparatus rapidly become choked with a sooty carbonaceous deposit.

(2) Those in which the oil is gasified in presence of a large volume of a very poor or non-luminous gas, such as water gas. The Lowe system, which is very much used in America, and has also been tried in London, may be taken as typical of this method. By this system there is only one ultimate useful product—viz., gaseous hydrocarbons, which are carried off by the large volume of water gas; the excess carbon being burnt off as carbonic acid or carbonic oxide in one of the stages of the process. This method yields a higher illuminating value per gallon of oil than any of the methods in the first class; but, although very large installations have been made at gas-works in London of the Lowe and kindred processes, the results both as to cost and as to the reliability of the processes to give a steady quality of gas, have not answered expectations. In America, where these processes are largely used, it must be remembered that coal gas is very dear, and oil at its cheapest, and that many things are put up with there which would not be tolerated in this country. It is also a great objection to the gas produced under these processes that it is so largely composed of the deadly poison, carbonic oxide gas.

There is another process used in London, whereby the gas made from English coking coal is raised from its normal illuminating value of about 15½-candle power to 16½-candle power; thereby enabling it to comply with the parliamentary standard for London, of 16 candles. This is done by vaporizing, by steam, a very light spirit, and mixing a small proportion of it with the common gas; but this is not a making of gas from oil, as the spirit is simply resolved into a vapour, which is carried along with the common gas. It saves the use of cannel coal for the same purpose; but it cannot be mixed with common gas in larger proportion than will raise the quality by from 1 to 1½ candles, and it is of no practical interest in Scotch gas-works.

The method of oil gasification introduced by Mr. Young, and now in operation at Peebles, differs so considerably from any of the processes already described, that it may be looked upon as a perfectly distinct system; and it embraces several principles which are novel. Briefly described, the process consists of a very gradual gasification of the oil by means of a *radiant* heat at a comparatively low temperature, and the scrubbing of the gas and oil vapours given off by the oil which is ultimately to be converted into gas. The oil vapours are condensed and returned again and again to the retorts along with the supply of fresh oil, till the whole is resolved into permanent gas of very high quality, and a quantity of very fine pure coke (very similar to still coke), equal to 5 cwt. per ton of oil used. It is found that, of the oil run into the retort at any one time, one-sixth is resolved into permanent gas, and five-sixths into oil vapours, which are condensed, and again returned to the retorts.

Generally speaking, the process appears to be a complete solution of the difficulty hitherto experienced in using heavy mineral oil gas for gas making. The plant is not expensive; being practically the same, as respects cost, as that which would be required for producing a similar quantity of coal gas—the make of gas per retort being about the same for both. The charge for repairs and maintenance would be considerably less than for coal-gas plant, as the working temperature is so much less; and the heavy wear and tear in coal-gas retorts, due to the drawing and charging every three hours, does not arise with oil-gas retorts, except to the very small extent involved in withdrawing the coke once a day. The oil gas is, besides, almost entirely free from sulphur or other impurity; so that the cost for purification would be very trifling as compared with coal gas. The process is also easily controlled, as, by increasing or diminishing the rate at which the oil circulates, the temperature (which outside the retort is from about 1180° to 1330° Fahr., and inside from about 900° to 1000° Fahr. when the retort is in operation) can be rapidly modified, and this without any deleterious effect on the ultimate

result; and therein lies one of the advantages of the process. In the old process of rapid and direct gasification, the exit-pipe from the retort, as well as the apparatus generally, is very liable to become choked with a carbonaceous deposit if the heat be too high, and especially when oil of high gravity is used; but, in Mr. Young's process, the introduction of the oil into the upstanding exit-pipe obviates this difficulty, as, if any signs of an obstruction are observed, it is merely necessary to quicken the circulation of the oil, when the carbon is washed down into the retort. Another great advantage is that any kind of oil can be dealt with by the process; and the tar from coal-gas manufacture could be equally well utilized by it, and made into gas. When the tar falls to such a low price as has been the case recently, it might be more profitable to make it into gas than to sell it; and, in any case, by so doing, and limiting the output of tar, a higher price would probably be maintained. With the other processes, every kind of oil would not be suitable.

The results obtained, as shown in the appendix, are far in advance of those from any of the other processes now in use. Professor Lewes, in a paper read before the Institution of Gas Engineers last year, gave as the highest results with the best oils for the purpose—viz., Russian distillate and intermediate oil—76 to 80 cubic feet of 50 to 60 candle gas. This was when the oil was "cracked" alone, as in the first class of processes referred to in this report. When "cracked" in an atmosphere of inert gas, as in the second class of processes, he found an increase in results of about 27 per cent.—say, equal to about 80 cubic feet of 70-candle gas, which is equal to 1120 candles per gallon. But the results obtained by Young's process (and with oils costing about 2d. per gallon, whereas those referred to cost about 4d per gallon) were 88·76 cubic feet of 90·59-candle gas, taking the coal gas as being equal to 18 candles, which is equal to 1578 candles per gallon; while, if our own analyses of the coal gas are taken—viz., 16-candle power—the results are 86·76 cubic feet of 100-candle gas, which is equal to 1735 candles per gallon.

It will be desirable now to see how the process compares, as regards cost, with gas made from the high-class coals with which, as an enricher, it has to compete; and also how the cost of a mixture of oil gas with gas from cheap splint coals compares with gas of a similar quality made from a mixture of cannel and splint coals. One gallon of oil in Mr. Young's process yields 86·76 cubic feet of gas; and, the specific gravity of the oil being ·885, there are 253·1 gallons per ton. The gas per ton is therefore 21,959 cubic feet; the illuminating value, as before stated, being 90·59 candles. This is equivalent to a value of 6820 lbs. of sperm. Comparing this with the best cannel coals, such as No. 1 Arniston and Newbattle, which have a value of about 1330 sperm candles per ton, each ton of oil gives results equal to 5⅛ tons of these coals. Taking two of the best cannels next to Arniston and Newbattle—viz., No. 1 Niddrie and Dryden—these have a value of about 1176 lbs. of sperm per ton; and each ton of oil is therefore equivalent to 5¾ tons of these coals. Taking, again, one of the best of the shaley cannels so largely used now for gas making—viz., Pirnie cannel—this is equal to about 1230 lbs. of sperm per ton; so each ton of oil is equivalent to about 5½ tons of this coal.

Coming now to the cost of producing the gas, the question of charge for capital may be eliminated on both sides, because the plant required for both is practically identical in cost for a given make of gas. The charges for repairs and maintenance may also be left out, although these will undoubtedly be less for the oil than the coal plant. The following may therefore be taken as the relative charges incurred; bearing in mind, however, that the coal charges are for actual working, while those for oil gas, as regards oil, are a very full (possibly an excessive) estimate:—

Cost of Gas from a Ton of Oil.

	£	s.	d.
Oil, 1 ton	2	0	0
Fuel for retorts, 12 cwt., at 7s. per ton	0	4	3
Labour and purification, at 3d. per 1000 cubic feet	0	5	6
Charge for royalty	0	2	6
Total	2	12	3
Deduct value of 5 cwt. of coke, which sells in Peebles at 20s. per ton, but say	0	2	6
Total	2	9	9

Arniston and Newbattle coal are at present being delivered in Leith at 33s. and 33s. 6d. per ton. Taking them at the first figure, at which they have quite lately been sold, the charges for 5¾ tons of the coal, which are of the equivalent value of a ton of oil, would be as follows:—

	£	s.	d.
5¾ tons of cannel, at 33s. per ton	8	9	1½
Labour and purification, at 7s. per ton	1	15	10
	10	4	11½
Deduct value of saleable coke, after providing fuel for heating the retorts, 36 cwt., at 7s. per ton, 12s. 7d.; do. liquid residuals at 1s. 8d. per ton of coal, 8s. 6¼d.	1	1	1½
Total	9	3	10

Or, taking these coals at the lowest price at which they have ever been sold—viz., 18s. per ton (in 1888):

	£	s.	d.
5¾ tons of cannel, at 18s. per ton	4	12	3
Labour and purification	1	15	10
	6	8	1
Deduct saleable coke and liquid residuals, as above	1	1	1½
Total	5	6	11½

No. 1 Niddrie and Dryden are at present being delivered in Leith at 28s. 3d. a ton. The charges for the equivalent of a ton of oil will be:

	£	s.	d.
5¾ tons of cannel, at 28s. 3d per ton	8	3	10
Labour and purification, at 7s. per ton	2	0	7
	10	4	5
Deduct value of saleable coke, 2 tons, at 7s., 14s.; do. liquid residuals, 9s. 8d.	1	3	8
Total	9	0	9

Or, taking these coals at the lowest they have ever been sold for—viz., 13s. 1d. per ton (in 1888):

	£	s.	d.
5¾ tons of cannel, at 13s. 1d. per ton	3	15	10½
Labour and purification	2	0	7
	5	16	5½
Deduct saleable coke and liquid residuals, as above	1	3	8
Total	4	12	9½

Pirnie cannel is at present being delivered in Leith at 18s. 4d. per ton. The charge for the equivalent of one ton of oil—viz., 5½ tons o coal—will be:

	£	s.	d.
5½ tons of cannel, at 18s. 4d. per ton	5	0	10
Fuel for firing retorts, 23 cwt., at 7s. per ton	0	8	1
Labour and purification, at 7s. per ton	1	18	6
	7	7	5
Deduct return for residuals, at 1s. 8d. per ton.	0	9	2
Total	6	18	3

Or, taking this coal at the lowest price at which it has ever been sold—viz., 12s. per ton (in 1888):

	£	s.	d.
5½ tons of cannel, at 12s. per ton	3	6	0
Fuel for firing, as above	0	8	1
Labour and purification	1	18	6
	5	12	7
Deduct return for residuals, at 1s. 8d. per ton	0	9	2
Total	5	3	5

Summarizing these calculations, the relative costs for the same amount of illuminating value are:

	Present Prices.	At Lowest Prices known.
Oil	£2 9 9	
Arniston and Newbattle cannel	£9 3 10	£5 6 11½
Niddrie and Dryden	9 0 9	4 12 9½
Pirnie	6 18 3	5 3 5

It appears, therefore, that gas from high-class cannels at current prices costs from three to four times as much for a given illuminating value as oil gas produced by Mr. Young's process; also that, at the lowest prices ever known for cannel coals, it costs about twice as much. Or, to put it another way, the price of oil might be raised from 40s. to 80s. per ton, and the oil gas would still be fully cheaper than gas from high-class cannels at the cheapest prices these have ever been sold at; or it might be raised to about 128s. per ton, and be as cheap as gas from Pirnie, or to about 170s. per ton, and be as cheap as gas from Arniston, Newbattle, Dryden, and Niddrie, at the current prices of these coals.

Coming now to consider the cost of a mixture of oil gas with gas from splint coal, I shall take it for granted that the Commissioners would not desire much to enhance the illuminating value of the gas as presently supplied, seeing that 26-candle power is as high as can be effectually consumed in ordinary burners. Taking it at that, therefore the proportions of the mixture would require to be:

	Candles.
10,000 feet of 15-candle gas from splint coal	150,000
1,666 „ 90 „ „ oil	149,940
11,666 feet of very nearly 26-candle gas	299,940

Splint coals, to produce 10,000 cubic feet of 15-candle gas, can be bought now at about 9s. per ton, delivered in the Leith works; and the cost of the mixture would therefore be:

	s.	d.
One ton of splint coal	9	0
Labour and purification, at 7d. per 1000 cubic feet	5	10
	14	10
Deduct saleable coke, 7 cwt., at 7s. per ton, 2s. 6d.; and liquid residuals, 1s. 8d.	4	2
	10	8
Add for 1666 cubic feet of oil gas	3	9
Total	14	5

This works out to a cost of 14·83d. per 1000 cubic feet.

Compare this now with the corresponding cost per 1000 cubic feet of gas, of about same quality, made in the Leith works since 1888, which was the cheapest year ever known; bearing in mind that 1888-9 is only for part of a year (omitting the months from May to August, when costs of manufacture are heaviest), and also that up to the beginning of the current year, the return for liquid residuals was much greater than it is now:

Year.	Average Cost of Coal per Ton.	Average Net Cost of Coal per Ton.	Cost per 1000 Cubic Feet of Gas made for Coal, Labour and Purification.
1888–89	10s. 5¾d.	7s. 5¼d.	15·97d.
1889–90	11 9½	8 9	17·12
1890–91	15 5	11 8¾	22·19
1891–92	19 4¾	16 5¼	26·69

The result shows the mixed gas from oil and splint coals to be fully 1d. cheaper per 1000 cubic feet than the cost of gas from a mixture of cannels and splints when these were at their very cheapest, and nearly 14d. per 1000 cubic feet cheaper than these were at the prices of last year. The cost for the current year will probably turn out to be about 3d. per 1000 cubic feet less than last year; and the prospect is that there will be a further considerable reduction in the prices for the year 1893-4. It is certain, however, that the prices cannot again be as low as from 1888 to 1890; it being well known that they were quite unremunerative to coalmasters, and that since then there have been considerable and permanent additions to the on-cost of coal. It is unlikely, therefore, that the average cost of coal will fall to a price which will bring the cost for it and for manufacturing charges less than 20d. per 1000 cubic feet made. The introduction of machinery for dealing with the coal would, no doubt, reduce labour charges considerably; but this would very slightly affect the relative costs, seeing that the mixed

oil and splint gas is made from coal to the extent of six-sevenths of he whole, and would benefit to this extent in any reduced cost of working the coal.

Taking, therefore, the above 20d. per 1000 cubic feet as the lowest probable cost for gas from a mixture of cannel and splint coals, there would be an advantage gained by the adoption of the mixed oil and splint coal gas process, not only as regards cost, but also as affording a check upon any rise in the price of cannel coals; that is, providing the cost for oil can be depended upon not to rise to such a figure as would add more than 5d. per 1000 cubic feet to the present cost of the mixture (14·83d.), and thereby make it equal to that of the (lowest) probable cost for a mixture of cannel and splint. To raise the cost of the 11,666 cubic feet in the mixture by 5d. per 1000 cubic feet would mean an addition of 4s. 10d. to the present cost of 3s. 9d. for the proportion (1666 cubic feet) of oil gas; and this would be equivalent to a rise in the price of oil of from 40s. to 105s. per ton. I have made careful inquiry on this point, and have been able to avail myself of the experience of several gentlemen thoroughly conversant with the oil trade; and, while it is impossible for anyone to tell with certainty what the future may bring, it seems hardly possible that so considerable a rise should take place.

I have no hesitation, therefore, in advising the Commissioners to erect plant for the manufacture of oil gas as soon as it is possible to do so. This cannot be done at Leith, under present circumstances, as there is no space available for the purpose, and the retorts are already too few for the quantity of coal gas needed in the winter months. But there is very considerable spare retort power in the Edinburgh works, part of which could probably be made available for oil gas. If the Commissioners, when they come to consider the report I had the honour to submit to them at this time last year, as to the enlargement and re-arrangement of the Leith works, approve of the scheme therein proposed, it can be arranged to make oil-gas plant part of it.

In the appendix it is stated that the oil gas is manufactured as nearly as possible in the proportion of one volume to six volumes of mixed gas, and that, taking the quantities made from 4 p.m. on the 8th to 10 p.m. on the 10th of March, they were 12,670 cubic feet of oil gas, and 68,500 cubic feet of coal gas; the coal used being a mixture of Auchlochan and Bellfield splint. Two syphons on the mains outside the works were tested on the 10th. About half a pint of water, and nothing else, was found in one; and the other, on a 7-inch main, was found "blowing." The oil-gas coke, which is of a very fine hard quality, is readily sold in Peebles at £1 per ton. A sample of it was brought to Leith. On being tested, it gave only 0·33 per cent. of ash; whereas the coke from an average mixture of cannel coals will give from 10 to 12 per cent. of ash. A sample of the coal gas produced from the mixed charge of splint coals was tested on the 10th of March, and gave 13·67-candle power. Applying this to the gas made from the 8th to the 10th of March, the following results are brought out:—

	Candles.
68,500 cubic feet of mixed gas, at 29·69-candle power	2,033,765
Of which 55,830 cubic feet are coal gas, at 13·67 candle power .	763,196
And 12,670 cubic feet of oil gas, at 100·28 candle power . . .	1,270,569

The analyses made at Leith of the coals used at Peebles show that, with a yield per ton equal to that given in the table of the three months' working there—viz., 9610 cubic feet—the average quality of the gas would not exceed 16-candle power. Applying this to the three months' working gives—

	Candles.
4,388,000 cubic feet of mixed gas, at 30·46-candle power . .	133,658,480
Of which 3,634,800 feet are coal gas, at 16-candle power . .	58,156,800
And 753,200 cubic feet of oil gas, at 100-candle power . . .	75,501,680

The higher the coal-gas result is taken, by so much is the oil-gas result depreciated; and taking the coal gas at 18-candle power, and applying it to the three months' working, gives—

	Candles.
4,388,000 cubic feet of mixed gas, at 30·46-candle power . .	133,658,480
Of which 3,634,800 feet are coal gas, at (say) 18-candle power .	65,426,400
Leaving 753,200 cubic feet of oil gas, at 90·59-candle power .	68,232,080

The Alexander-Paterson process has been seen in operation at Woodilee Asylum, Lenzie, near Glasgow, where there are 12 retorts erected; being the largest installation as yet made. The result per gallon of oil is stated, in the prospectus of the Company, to be about 90 cubic feet of 60-candle gas, with about 10 per cent. (in bulk) of a thin oily tar, and a small quantity of a pitchy deposit in the retort. The results stated to be obtained are very similar to those arrived at by other processes of the same class. Lately some experiments have been made with a retort on the premises of the Company in Glasgow, in the direction of making a smaller quantity of gas of a higher quality per gallon, and trying the effect of mixing this with ordinary Glasgow gas. There is subjoined a report by Mr. R. R. Tatlock, Public Analyst and Gas Examiner for the City of Glasgow, of a test made by him, in which, however, there is no information as to the quantity of gas made per gallon of oil when the gas with which he experimented was produced. The quantity of the gas made per retort was stated to be 2000 cubic feet per 24 hours. With our coal-gas retorts, and with the retorts in Young's process (which, however, are larger), about five times this quantity is made per 24 hours; so that the Alexander-Paterson process would require, relatively, a very large amount of plant for the manufacture of a given quantity of gas. To fit up a small plant of these retorts, as proposed in Mr. Holms's letter to the Lord Provost [of Edinburgh], would not be of any service unless the apparatus were made complete throughout, so that the oil gas could be mixed in a holder with a given quantity of coal gas of ascertained quality, and the results carefully tested. To do this, and provide not only for retorts and condensers, but for exhauster, purifiers, meters, and gasholder, would cost nearer £2000 than £200; and I cannot recommend the Commissioners to incur that expense. The Patent Paraffin Gas Lighting Company should do as has been done by Mr. Young at Peebles—viz., get the use of a small gas-works, and put up plant there on a working scale, with the necessary apparatus for checking exactly the results obtained as to quantity and quality. If they are then satisfied that the results obtained are better than those from other processes, an opportunity can be afforded to those interested in the matter to test the working for themselves, as has been done at Peebles with Mr. Young's process.

[Mr. Tatlock's report follows, as given in the JOURNAL last week (p. 689). Appended to it is an analysis of the gas, showing 7·71 grains of sulphur per 100 cubic feet. Referring to this result, Mr. Tatlock says it indicates that the gas is very free from sulphur, "containing as it does, only one-half of that present in the purest gases, such as London gas, as fixed by Act of Parliament. If we take the illuminating power of the gas as being three times that of London gas, it will be seen that the above figure should be really divided by three; which makes the sulphur, on the basis of equal luminosity, only one-sixth of that present in London gas."]

The Committee unanimously adopted the report, and gave instructions for plans and estimates for the erection of the necessary plant at the Edinburgh works to be prepared. They also resolved to visit Peebles this week, to see the plant at work.

STALYBRIDGE CORPORATION GAS SUPPLY.

Annual Report of the Engineer and Manager.

The Engineer and Manager of the Stalybridge Corporation Gas-Works (Mr. Ernest A. Loam) has presented to the Gas Committee his report for the year ending the 25th ult., from which we take the following particulars:—

The amount of coal and cannel carbonized was 12,001 tons 4 cwt., against 12,745 tons 19 cwt. in the preceding year, or a decrease of 744 tons 15 cwt. The make of gas per ton of coal was 10,726 cubic feet, against 10,486 cubic feet in 1891-2. The quantity of gas made was 128,728,400 cubic feet, as compared with 133,662,700 cubic feet, or a decrease of 4,934,300 cubic feet. The gas sent out was 128,721,400 cubic feet, against 133,740,000 cubic feet last year, or a decrease of 5,018,600 cubic feet. The cost of coals, after deducting the sum received for residuals, was £5447 18s. 5d.; and the working expenses for manufacture, distribution, &c., came to £5778 17s. 7d.—making a total cost of £11,226 16s., against £11,448 0s. 3d. last year, or a decrease of £221 4s. 3d., equal to 18s. 8·51d. per ton, against 18s. 1·55d. per ton last year. The average illuminating power of the gas was 19·05 candles. With regard to residuals, Mr. Loam expresses regret that the return for the past year shows a desperate falling off as compared with the preceding twelve months; the contract for tar, and liquor being 8s. 6d., against 16s. 9d. per ton. The largest weekly consumption of gas during the past year was 4,276,100 cubic feet. The gas sent out from March 25 to Oct. 25 (seven months, up to the stoppage of the mills) was 50,463,800 cubic feet, against 46,483,900 cubic feet in the corresponding period of 1891, or an increase of 3,979,900 cubic feet. The 20 weeks stoppage of the mills had a most disastrous effect on the consumption of gas; the quantity then sent out showing a decrease of 8,370,200 cubic feet, as compared with the corresponding period of 1891. Had it not been for the stoppage, the consumption of gas in the year 1892-3 would have exhibited a most satisfactory increase.

Mr. Loam devotes a large portion of his report to dealing with the causes which generally give rise to grumbling on the part of consumers. He points out the necessity for having good burners and fittings; and he reminds them that this matter should have their serious attention, so that those who are responsible for the manufacture of the gas should not be, as they generally are, undeservedly blamed for its so-called deficiencies. On the subject of the use of gas for other than illuminating purposes, he expresses a decided opinion that every encouragement should be given to the adoption of gas-stoves. He is devoting considerable attention to this question; and he reports satisfactory progress so far.

A matter which is a source of trouble to Mr. Loam is his leakage account. He firmly believes that it is due principally to defective service-pipes, caused by corrosion after having been in the ground for many years. He says he had frequently seen the condition of these pipes when taken up; and he knows from experience that escapes are not so much due to the defects of the mains as of the services. In supplying a street with gas, he recommends that all mains should, if possible, be laid under the footpath; and then there would be no need to disturb the street, or any fear of the steam-roller.

Referring to his new telescopic gasholder with a capacity of 750,000 cubic feet, Mr. Loam says it will enable the Committee to supply the district in the most efficient manner; and it also places in their hands a large amount of reserve storeage that will be equal to meet any extraordinary demand for gas in the winter months.

Reduction in the Price of Gas in the South Metropolitan Company's District.—In accordance with the announcement made in their last half-yearly report, the Directors of the South Metropolitan Gas Company have reduced the price of gas in their district to 2s. 5d. per 1000 cubic feet, as from the 25th ult. The occasion has been chosen by the *Daily Chronicle* for a few editorial reflections, in which the Company's policy is contrasted with that of their big neighbour on this side of the river. After stating that the South Metropolitan Company's increase of 3d. per 1000 was "to make the consumers pay the expenses of the contest between the masters and the men," the writer points out that "The Gaslight and Coke Company had no strike; but a few months ago the Directors raised the price of gas in view of a threatened scarcity of coal. Coal is much cheaper now, and yet we hear of no reduction in the price of gas north of the Thames." He then goes on to say: "If the South Metropolitan Company, with a definite loss to meet, can now begin to revert to its former rates, surely the other Company, with a far higher rate, and certainly no better gas, ought to be compelled to reduce its charges. Or have we absolutely no control over this huge monopoly other than the 'automatic' action of reduction when dividends increase? And plenty of poor people are robbed meanwhile."

DEDUCTIONS FROM WAGES FOR SICK FUNDS IN GAS-WORKS.

A case was before the Leicester County Court last Wednesday in which a labourer, named Isaac Fitz-John, claimed from the Mayor and Corporation an amount of wages earned, but not paid. Plaintiff was represented by Mr. Watson Wright, who stated that he was employed at the gas-works from Sept. 20, 1889, to June 3, 1892. During that time 4d. per week was deducted by the officials, which amounted, for the period of his employment, to the sum of £2 5s. 4d. It would be said by the other side that, of course, the man agreed to it; but he (Mr. Wright) submitted that that did not make the slightest difference to the claim. This 4d. per week was stopped as a contribution to a sick fund; and his case was that it was an illegal deduction by reason of the Truck Act. In reply to his Honour, Mr. Wright contended that it was legal to stop wages for medical attendance, and where payment was actually made, but not as a contribution to a sick fund. He also claimed 5s. 7d. for death levies which had been stopped from his client's wages, and which brought up the total claims to £2 10s. 11d. In examination, plaintiff said his wages were 35s. per week; and, in cross-examination by Mr. Toller (who appeared for the Corporation), he admitted that he was employed by the Corporation in 1882, when a system of voluntary payments to the sick fund was in vogue. He then paid the contributions. Some workmen had told him that they had petitioned the officials to deduct the contribution, in order to save the expenses of collection. He had received a copy of the rules, and had objected to a Mr. Law, against paying the 4d. a week. In answer to his Honour, Mr. Wright said they did not dispute for a moment that the sick fund had been properly conducted. Witness further acknowledged that he seen a list giving a statement of accounts. In summing up, his Honour referred to a case which had come before Mr. Justice Bowen. The decision of that Judge was that deduction was illegal, and was not to be made by a pretence of any kind, however excellent or beneficial to the workmen. The wages must be paid in hard cash. But the decision went further, and said that where the workmen assented that the employer should use the money deducted in a particular way, the ordinary principles of law applicable to trusts applied. Judgment would therefore be given for the defendants with costs. Mr. Toller stated that since these proceedings were commenced there had been a meeting of the workmen employed in the Gas Department condemning the action.

THE RECOVERY OF TAR AND AMMONIA FROM BLAST-FURNACE GASES.

Reference has already been made in the JOURNAL to the plant designed by Mr. A. Gillespie, of Glasgow, for the recovery of the tar and ammonia from the blast-furnace gases at the Clyde Iron-Works (Messrs. James Dunlop and Co., Limited). We are now in a position to give some particulars of the plant, which is very extensive, and deals with the gases from four furnaces. The gases are conveyed in an overhead main, 7 ft. 6 in. diameter, to the primary washer. The main is fitted with large dust-traps, where most of the dust particles carried forward from the furnaces are caught and removed. In this washer the gases are passed through several divisions fitted with multiple serrations partially sealed in water or tar, where the last of the dust particles are removed, and the heavy tars deposited. From the primary washer the gases pass into the condensers, consisting of a series of cast-iron chests with wrought-iron vertical pipes, 20 inches in diameter and 54 feet high, where the high temperature of the gases is lowered to about 70° Fahr. At this temperature they are ready to enter the liquor washer, where they are broken up into minute streams, and agitated through a water-seal, depositing tar and ammoniacal liquor. They then pass into a second (or acid) washer, and are subjected to a similar process. This washer is so constructed that, if needful, the last traces of ammonia can be extracted from the gases by passing them through weak acid. Being now freed from tar and liquor, the gases pass by three branches to the exhauster-house, where three powerful exhausters draw them forward through the various seals, and impel them through a return main, which is 4 ft. 6 in. in diameter, towards the steam-boilers and blast-stoves. The products extracted during this process are, by means of their specific gravities, automatically separated in special vessels; the tar flowing into one division of a large stock-tank, and the liquor into another. From these they are run into blowers as required, and forced by compressed air into high charging-tanks, whence the tar gravitates into tar-stills, to be distilled into oils, boiled tar, and pitch, and the liquor goes into the sulphate-house, where it is converted into sulphate of ammonia, which is automatically discharged into overhead trucks, drained, and made ready for packing and sale. The plant was started on the 10th inst.; and sulphate was produced within the week. The tar-stills are already giving off oil; and they will be running pitch in due course. As already mentioned, similar plant has been designed by Mr. Gillespie for the Dalmellington Iron-Works; but, having to deal with the gases from six blast-furnaces, some portions of it, such as the exhausters, are on a larger scale. It was started at the end of January last; and it has developed very satisfactory results in the production of sulphate of ammonia, oil, and pitch.

THE CHESTERFIELD CORPORATION AND THE WATER AND GAS COMPANY.

A storm, which has been brewing for some time past between the Chesterfield Corporation and the Water and Gas Company, broke out (says a Derbyshire paper) last Wednesday week, when some exciting and ludicrous scenes were witnessed in Boythorpe Lane. The origin of the difference between the two authorities is difficult to get at; both sides being somewhat reticent on the matter. The immediate cause of the dispute, however, and the one which brought matters to a climax, is in relation to the water supply to the lodge in the Queen's Park. This lodge having now become inhabited, a supply of water for domestic purposes was consequently needed. Our contemporary is informed that a certain qualified plumber in the town saw Mr. C. E. Jones, the Manager, and was assured by that gentleman that a ¾-inch pipe of a certain quality and weight would satisfy him. This, however, is a matter concerning which there is some disagreement. The contention of the Corporation is that they served the Water Company with a proper and legal notice to connect the park lodge with water, and in every respect complied with their bye-laws and regulations. The latter, on the other hand, allege that the Corporation have defied them, and refused to consult them on the matter, and had instructed an unauthorized person to connect the pipe with the Company's mains—a proceeding which the Company consider to be illegal, and a violation of their regulations. On these grounds, they refused to connect the lodge with their mains. On the morning in question, the Corporation officials gave the Company notice that, inasmuch as they had not complied with the notice which had been served upon them, the Corporation had arranged to make the connection themselves. At eleven o'clock some Corporation workmen, acting under the directions of Mr. Stanton, the Borough Surveyor, proceeded to Boythorpe Lane to connect the pipe with the Company's main. Mr. Jones, however, considering that it was his duty to protect the Company's property, immediately sent down a gang of workmen, who filled in the ground as fast as the Corporation workmen could throw it out. This horse-play went on for some time; and when the Company's men got the best of the argument, hostilities for the time being ceased. The Town Clerk, who was out of town that day, was informed by telegraph of the result of the attempt to make the connection; and he wired back: "Get more men to prevent obstruction to Corporation men, but use no unnecessary force." In the afternoon, the attempt was renewed. About 15 of the Gas Company's men, armed with shovels, assembled, and stood in a body on the place where excavations were necessary. A little later the Corporation men, about 15 in number, and carrying shovels and picks, put in an appearance. They were greeted with cries of "Play up, Corporation," from the crowd gathered round; and they lost no time in responding. The Gas Company's men retained their position, though the picks of the Corporation men came dangerously near pinning them to the ground on several occasions. The inactivity of the Company's men, however, was not long sustained; for no sooner had the Corporation men got a few inches of earth out, than they commenced to replace it. Then began a royal battle, at first contested with good humour; but before it had been in progress many minutes, matters assumed a more serious aspect. Shovels, picks, stones, dust, and earth began to fly about in all directions; and, in a few minutes more, it appeared to the observers through the cloud of dust that each of the combatants had picked his man, and instead of endeavouring to remove or replace the ground as the case may be, they began pelting each other with the contents of their shovels. In order to get the earth away, the Corporation men commenced to throw it as far out as they possibly could; and the spectators consequently came in for a good "dusting." Back again it went; and during the *melée* one of the men engaged in the strife was caught in the face with a stone, which caused a large wound, from which blood flowed freely. In the meantime the Borough Surveyor had put in an appearance; and, seeing that matters were likely to become serious, he decided to call his men off, saying he did not want brute force. The ground was then replaced; victory, for the time being, thus resting with the Company.

METROPOLIS WATER SUPPLY.

The Quality of the Water in the Past Month.

The returns furnished to the Registrar-General by the London Water Companies as to the water supply of the Metropolis during the month of March show that the average daily supply was 182,275,807 gallons, as compared with 181,507,050 gallons in the corresponding month of 1892. The number of services being 792,467, the rate was 230 gallons per service. Of the entire bulk of water sent out, 92,193,842 gallons were drawn from the Thames, and 90,081,965 gallons from the Lea and other sources. Reporting upon the quality of the supply, Dr. E. Frankland said: "Taking the average amount of organic impurity contained in a given volume of the Kent Company's water during the nine years ending December, 1876, as unity, the proportional amount contained in an equal volume of water supplied by each of the Metropolitan Water Companies and by the Tottenham Local Board of Health was: Kent, 0·4; Tottenham and East London (deep well), 1·4; Colne Valley, 2·3; New River, 3·5; East London (river supply), 4·3; Chelsea, 4·4; Grand Junction, 6·1; West Middlesex, 6·3; Southwark, 7·0, and Lambeth, 7·3. The unfiltered river waters exhibited the following proportions: New River cut, 1·7; the Lea at the East London Company's intake, 2·4; and the Thames at Hampton, 3·4. These results are instructive, as showing that the raw river waters were chemically of much better quality on the 20th and 22nd of March than the stored and filtered water delivered by any of the Companies on the 3rd of March. Bacterially, however, all the filtered waters were enormously better. The Thames at Hampton was, on March 20, turbid and very pale yellow. Bacterially, it was nearly four times better than on Feb. 4. Contrasted with the raw river water, the supplies of the five Companies drawing from this river showed the following percentage bacterial improvement: Chelsea and West Middlesex, 99·7; Grand Junction, 99·6 (Kew filters) and 97·9 (Hampton filters); Southwark, 98·9 (well No. 2), 97·9 (well No. 3), and 98·7 (unfiltered gravel water); and Lambeth, 99·5. The water was efficiently filtered in every case. The unfiltered water taken chiefly from the Lea by the New River Company on March 22, was turbid and nearly colourless. Bacterially, it was more than three times as good as on Feb. 7. It was efficiently filtered before delivery, and was, after filtration, equal to the West Middlesex water in respect of bacterial purity. The raw river water taken from the Lea by the East London Company on March 22, was turbid and very pale yellow.

Bacterially, it was nearly three times as good as on Feb. 7. It was efficiently filtered before delivery, and was bacterially improved 99·2 p.ct. (Essex well No. 1). Contrasted with the raw river water at the intake, the water delivered upon the filters of this Company on the same day, but after 13·7 days' storeage, exhibited a bacterial improvement of 83·9 p.ct. The deep-well waters of the Kent and East London Companies and of the Tottenham Local Board of Health were of most excellent quality for dietetic purposes; the Kent Company's water being again distinguished for its very high organic and bacterial purity. The water of the Colne Valley Company contained a somewhat larger amount of organic matter than is usual in deep-well waters. It was softened before delivery, and thus rendered suitable for washing. The Tottenham and East London waters were very slightly turbid, but the remaining deep-well waters were clear and bright without filtration. Seen through a stratum 2 feet deep, the Kent water was clear and colourless; the Colne Valley, clear and nearly colourless; the Tottenham and East London (deep-well), colourless and very slightly turbid; the New River and East London (river supply), clear and very pale yellow; the Chelsea, clear and pale yellow; and the remaining waters clear and yellow. The bacteriological examination by Dr. Koch's process, of the raw river and gravel waters, and of those supplied by the various Companies, collected on the 20th, 21st, and 22nd of March, gave the results contained in the following table:—

	No. of Microbe Colonies per Cubic Centimetre.		Temperature in Deg. C.
Raw River Waters.			
Thames at Hampton	3737	..	7·0
New River cut	500	..	7·6
Lea at Angel Road	2350	..	7·7
River Supplies.			
Chelsea	11	..	8·1
West Middlesex	12	..	7·3
Southwark, No. 2 well	42	..	7·8
„ No. 3 „	80	..	7·5
„ Gravel water*	50	..	8·5
Grand Junction, Hampton filters	78	..	8·2
„ Kew „	14	..	8·0
Lambeth	20	..	7·3
New River	12	..	7·0
East London	18	..	7·3
Deep Well.			
Kent	4	..	11·4

*This water is filtered before being supplied.

Thus, the deep-well water of the Kent Company contained, as it issued from the pumping-shaft at Deptford, the smallest number of microbes; while among the river-derived supplies, the Chelsea, West Middlesex, and New River Companies were distinguished for sending out water containing a very small number of microbes per cubic centimetre."

In the course of their report to the Official Water Examiner for the past month, Messrs. Crookes and Odling say: "In our report for the month of February [*ante*, p. 557], we called attention to the degree of colour-tint of the water then being supplied, which, though insufficient to be noticeable in small bulks of the water, became very apparent on its being submitted to definite colorimetric examination. During the first ten days or so of the succeeding month, while the river still continued in flood, the degree of colour-tint of the supply, taken notice of in our previous report, did not manifest any appreciable reduction; but during the remainder of the month, alike in degree of freedom from colour-tint, and in the smallness of the amount of organic matter present, the condition of the water supply was unexceptionable. In the supply for the entire month, indeed, taking the Thames-derived water for illustration, the mean proportion of organic carbon present was found to be 0·172 part in 100,000 parts of the water, with a maximum of 0·272 part in any single sample examined, as against a mean of 0·185 and a maximum of 0·286 part in the previous three months' supply. Again, the mean amount of oxygen required to oxidize the organic matter present was 0·057 grain per gallon of water, as against a mean of 0·063 grain per gallon in the previous three months' supply. Of the entire 182 samples of water examined during the month, three were recorded as wanting in brightness, and one as being slightly turbid; the remaining 178 samples being well filtered, clear, and bright."

Exhibitions of Gas Appliances.—From Tuesday to Friday last, an exhibition of Messrs. Wilson and Son's gas cooking and heating stoves was held at Seaford. Miss Garstin, of the Kensington School of Cookery, practically demonstrated every afternoon and evening the excellent results which can be obtained in cooking by means of gas-stoves.——Under the auspices of the Gas Committee of the Retford Corporation, an exhibition of gas appliances was recently held in the Corn Exchange in that town, under the supervision of the Gas Manager (Mr. J. B. Fenwick). The services of Miss Shaw, of the Nottingham School of Cookery, were secured to show the capabilities of the stoves on view; and this she did twice daily to appreciative audiences during the period of the exhibition.——The Davis Gas-Stove Company, Limited, have been busy lately holding exhibitions at Bristol, Darlington, Eastbourne (in conjunction with Messrs. Fletcher, Russell, and Co.), Fareham, and Waltham Cross; lectures on cookery being delivered by Miss Ida Cameron, Miss Ellen Johnston, and Mrs. Springthorpe.——An exhibition of gas appliances was held in Cambuslang during last week. The exhibitors were the Scottish Gas-Stove Company, of Eglinton Street, Glasgow, who made a good show. Miss Phillips, of the South Kensington School of Cookery, gave the lectures and demonstrations. The Directors of the Gas Company, acting on the advice of their Manager (Mr. J. Donaldson), were the originators of the exhibition; and they have every reason to be satisfied with the result. The low price of gas—2s. 11d. per 1000 cubic feet—has, we learn, led to a large demand for stoves on hire.——A very successful exhibition of gas appliances was held by Messrs. W. Parkinson and Co., in the Assembly Rooms, Handsworth, Birmingham, from Monday to Friday last week. Miss Sanderson gave cookery lectures twice daily; and the hall was crowded on each occasion.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

In another part of the JOURNAL is given a summary of a most important report to the Edinburgh and Leith Gas Commissioners on oil gas processes, by Mr. F. T. C. Linton, their Engineer at Leith. Mr. Linton has gone into the subject thoroughly; and has produced a most exhaustive document upon the working of Mr. Young's process at Peebles. It is evident that, in his opinion, no other oil gas process has established itself sufficiently to be at all named along with Mr. Young's. That is the conclusion which all have arrived at who have seen the plant at work. It is true that within the past week or two a competitor has entered the field, in the shape of the Alexander-Paterson process, which is the property of the Patent Paraffin Oil-Gas Company, of Glasgow. This is an old process which appears to have been spurred into activity by the interest which has been taken in Mr. Young's system. It will be observed that Mr. Linton makes practically the same complaint which I did two weeks ago, regarding the article in the *Glasgow Herald* explaining it, that information was not given which would enable anyone to decide as to the value of the invention. The same remark applies to an article upon the Alexander-Paterson process which appeared in the *Scotsman* last Monday, and which was very similar, in its information, to the one upon the same subject in the JOURNAL of last week. A very important omission is as to the permanency of the gas produced by the Alexander-Paterson plant. Your readers who have taken an interest in Mr. Young's process know that this is a feature of it; and Mr. Linton's statement regarding the opening of the syphons at Peebles establishes it. Oil may be vaporized, but not fully "cracked up," as the expression is, or gasified; and though the vapours will give a very brilliant light, they are not permanent, and never reach the consumer who lives at a distance. Of course, the Alexander-Paterson gas may be as permanent as that produced at Peebles; the difference lies in this, that at Peebles inquirers were informed as to the permanency of their products, but in the case of the Alexander-Paterson system the presumably inspired articles upon it which have been published contain no reference to that point. Another omission is as to the oil which can be employed. The article in the JOURNAL states that it was ·865. That is not a high gravity oil; and it is not stated whether the plant is capable of dealing with oils of higher gravity. I repeat that I am not pointing out defects in the invention, but in the published articles upon it. If these can be amended, so as to give the information which it is essential a gas manager must have before he can recommend its adoption, the process would have a much better chance of success. Mr. Young has benefited by the judicious manner in which he has put his plant before the public. As has been stated more than once in this column, everyone was allowed to see it at work; and every result was made as plain as language could make it. His reward has been the adoption of his process by so many places, even before the final specification of the patent which he and Mr. A. Bell hold for it was filed. The specification has now been filed; and almost as soon as it has been lodged, the Galashiels Gas Company will be able to obtain a licence for working the patent. Its adoption by Edinburgh is a matter of which the patentees may be proud. I know that some of the Commissioners were disposed, as I conclude that some gas managers are, to hold the notion that the cheapening of coal would make it unnecessary to fall back upon oil as an enricher. Mr. Linton's figures, giving comparisons with coal when it was at its cheapest, entirely dispel that idea. That portion of the report is specially worthy of perusal. One circumstance may be pointed out. The report on this occasion is by Mr. Linton; and the recommendation is to establish oil-gas plant in the Edinburgh works. It is not to be inferred that Mr. Mitchell is not so favourable to enrichment with oil as Mr. Linton. I know that, as a matter of fact, he is; and I assume that the reason Mr. Linton was selected to investigate the subject was that at one time Mr. Mitchell was employed along with Mr. Young, and the Commissioners may have desired to remove all possibility of anyone saying that the report was otherwise than strictly impartial. The Commissioners meet on Monday, when the report and recommendation come up for consideration. There is also on the *agenda* a letter from Mr. Holms, referred to by Mr. Linton in his report, with reference to the Alexander-Paterson process. This may lead to a proposal for delay in the adoption of Mr. Young's system till inquiry can be made; but, on the other hand, Mr. Linton's report is so explicit in favour of Mr. Young's process, that any such suggestion is not likely to receive much support.

The Edinburgh Town Council have resolved to retain the supply of electric lighting in their own hands. The arguments used in favour of this policy were that it was inadvisable to allow a company to get hold of an undertaking which might require to be bought out at some future day, at a ransom; that it was desirable that the Council should retain in their own hands control over the streets; and that the Council could manage the undertaking as economically as a company. These are all debateable points; but, without touching upon them, it may be pointed out, as a significant commentary upon their boast that they could manage the undertaking as well as a company, that, though they have had since July, 1891, to consider what they were to do under their Provisional Order, now when they have taken up that question they do not know their own mind upon it. It actually took them four hours yesterday to discuss it; and the discussion was upon all points of the subject except the all-important one of how it would affect the community. This is a matter to which they purposely shut their eyes. A deputation of residents within the compulsory area waited upon the Council, and lodged the memorial to which I referred last week, praying that the undertaking should be handed over to a company. Unfortunately, the deputation put forward to speak for them a young advocate who did not seem to know much about the subject, and whose remarks gave the councillors the impression that the deputation were speaking in the interest of shareholders expectant of big dividends rather than on behalf of the citizens. Mr. J. M. Turnbull followed, and endeavoured to put the Council on the right track by quoting figures to show the prices charged in places where the electric light has been established; but he was promptly stopped. The Lord Provost then moved approval of the recommendation that they should retain the undertaking. His Lordship is a

shrewd gentleman, and is well aware of the tricks of electricians in promoting business; but his shrewdness surely deserted him when he made the statement that he had discouraged the taking up of the subject since the Provisional Order was passed, and that now they had only just time left in which to have the works and plant laid down, if they were to avoid the penalties exigible under the Order. The right policy, one would think, would have been to set about considering their position as soon as they obtained the Order; and if they wished to delay till they saw how other places were doing, they did not require to come to a decision as to what they were to do till the last moment. In that event, instead of presenting the appearance, as they did yesterday, of being "as sheep without a shepherd," and requiring twenty long speeches to explain what they considered to be their views, but which in reality showed their want of knowledge of the subject under discussion, they would have been able, probably, to have arrived at a unanimous decision in half an hour. They have hurriedly smuggled the thing through, without ever informing the community on a single point as regards cost. All they have to go upon is the flying visit of a deputation of their number to England, where, in five days, they imagined they learned all that was necessary for them to know, and the report of Professor Kennedy, in which there is only the Professor's opinion without any data. To discuss, upon its merits, whether the Corporation or a company would best manage an electric lighting installation, would be of no use now. The Council have decided without considering the subject, and without giving any reason for the decision they have come to. If they manage the undertaking in the same way, it is to be feared that their management will only result in mismanagement.

I wrote cautiously last week about the announcement in a Dundee newspaper with reference to the position of the Dundee Gas Commission, because, from internal evidence, it seemed not to be sufficiently inspired to be reliable. This week another local paper takes up the tale; and while giving the same agreeable account of the prosperity which has attended this year's working of the gas undertaking, it goes on to state its belief that there will be a reduction in price of 4d. per 1000 cubic feet. The other paper, it will be remembered, took it for granted that the surplus would be required to pay the deficit upon the working of the electric lighting installation. Probably the truth will be found to lie between the two statements; but it is a matter about which there is nothing to be gained by speculating. What is of consequence in this week's statement is that the tenders for the supply of coal for next year show a large reduction—in some cases as much as 20 per cent. This is a circumstance which is worth knowing. If 20s. coal can be had for 16s., and 15s. coal for 12s., it will be a benefit which all engaged in the gas industry will appreciate.

Yet another resignation of a Gas Manager falls to be intimated this week—that of Mr. Jas. Gemlow, of Cupar-Fife. Mr. Gemlow has been Manager of the Cupar Gas-Works for 27 years; having been appointed to the post after Mr. W. Mackenzie, who died the other day, went to Dunfermline. As was stated a week or two ago, the Cupar Company is being reconstructed as a co-partnery. The Company are about to execute considerable alterations and extensions upon their works, including a new system of retort-firing. Mr. A. MacPherson, of Kirkcaldy, is the adviser of the Company.

The Lockerbie Gas Commissioners have resolved to reduce the price of gas from 6s. 8d. to 6s. 3d. per 1000 cubic feet. They have also decided, acting on the advice of Mr. J. Hepworth, of Carlisle, to make considerable improvements in the gas-works, including plant for a trial of Mr. Young's process for enriching the gas by oil.

A serious explosion of gas occurred in Glasgow on the morning of last Saturday. The occurrence differed from the ordinary explosion of gas in respect that it took place in the street. Glasgow is at present being bored under in all directions in connection with the construction of underground ways. One of these goes along Great Western Road; and some time ago the workmen were driven out of the workings by an inflow of water. The water has been pumped out; and it is supposed that the abstraction of the water had created a cavity under the roadway, as the result of which the gas-main had been damaged, and the cavity had filled with gas. The roadway had been constructed over an old quarry at the place, which lends probability to this view. Workmen were sinking a shaft when the explosion occurred—caused either by a spark from a pick, or by the flame of a lamp. The explosion was a very violent one; and it caused the death of two of the workmen, and the injury of two others. A hole 10 feet deep and 20 feet square was made in the roadway; and the gas and water service-pipes were damaged.

An accident occurred in the Inverness Gas-Works on Monday morning, by which two men were killed. Along with another man who escaped, they were removing the ironwork of an old gasholder tank which has been rendered unnecessary by the new gasholder just constructed. They were working upon a scaffolding about 5½ feet in height; and had loosened a plate, when it suddenly fell into the tank upon them. The two men were buried under it and the earth which fell along with it. As soon as possible they were extricated; but both died—one of them in a few minutes, and the other five hours after.

The Broughty Ferry Gas Commissioners have received 55 applications for the post of Manager of the Gas-Works, vacant by the retirement of Mr. George T. Myers; and out of the list they have selected a short leet of five.

At a meeting of the Glasgow Town Council on Thursday, Mr. Waddel, in moving the adoption of the minutes of the Water Committee, called special attention to the statement that the construction of the viaducts crossing the Kelty and Duchray waters, in connection with the augmentation of the water supply from Loch Katrine, is drawing to a close. There only remains about half a mile of the concrete invert to put in, and some short lengths of lining, to complete the work. It is expected that the whole will be ready for the water to be turned into it before the end of June. When it is brought into use, some additional water may be drawn from Loch Katrine for the supply of the city. The section is 6¼ miles in length; and the work has been very heavy.

The Glasgow Water Commissioners have let a contract for the supply of 1033 tons of water-pipes to Messrs. Cochrane, Grove, and Co., of Middlesbrough, at the price of £4750, which is at the rate of £4 12s. per ton, delivered in Glasgow. The other offers were: Messrs. D. Y. Stewart and Co., of Glasgow, £4816; Messrs. Laidlaw, of Glasgow, £4888; Messrs. R. M'Laren and Co., of Glasgow, £4970; and Messrs. Macfarlane, Strang, and Co., of Glasgow, £5048. It is curious that so many local firms should be ousted by one at such a distance. The cost of coal and iron, as well as wages, must be much lower in the North of England than in Glasgow.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *April* 22.

Sulphate of Ammonia.—A quieter state prevails; and there is a pause in the consumptive demand. Nevertheless parcels offered are still being taken up by the dealers, which leaves sellers to conclude that requirements still exist in that quarter. There is a fair inquiry for future contracts, which are now little offered, and for May delivery there is considerable inquiry; but there is barely anything available, and offers can only be obtained with difficulty. The prices offered for next month furnish an indication that, whatever may be the reports sent abroad, it is in reality not anticipated that prices will be much lower; and as it is certain that great scarcity will contine to prevail, the coming month may eventually prove worthy of its predecessor concerning values. For spot parcels, £12 10s. is now quoted again; and £12 2s. 6d. and £12 5s. can be realized for May delivery. From June forward the quotations are irregular; and, according to reports from Germany, the "bears" are at work again, for they have sold, and are offering freely, on a basis rather below £11 10s.

LONDON, *April* 22.

Tar Products.—Benzols are distinctly flat, especially 90 per cent. There appears to be a conspiracy on the part of buyers to depress benzol; and, unfortunately, the tactics of sellers during the past two months have certainly assisted buyers' operations. The make is rapidly falling off; and if buyers are wise, they will not force sales until the demand assumes a healthier aspect. So far as 50's are concerned, aniline makers must have them; and, as they cannot get this quality either from carbonizers or coke-ovens, distillers should be able to command a fair price for what they have to sell—at any rate, during the next few months. Pitch keeps moderately firm, notwithstanding rumours to the contrary. Most makers are well sold for this season, and are comparatively indifferent to the efforts being made to reduce the price. No important business is reported in other tar products; but anthracene is firmly held, at prices mentioned below. Tar acids are likely to see higher prices, but there is very little offering. Prices to-day are: Tar, 12s. 6d. Pitch, 24s. to 25s. 6d. Benzols, 90's, 1s. 5d.; 50's, 1s. 4d. Solvent naphtha, 1s. 1½d. Toluol, 1s. 4½d. Crude benzol naphtha, 30 per cent., 7d. Creosote, ¾d. Creosote salts, 17s. Carbolic acid, 60's, 2s. 4d.; 75's, 2s. 10½d.; crystals, 7½d. Cresol, 1s. 10d. Anthracene, nominal, 30 per cent., "A," 1s. 1d.; "B," 9d.

Sulphate of Ammonia.—This market appears to have revived from the falling tendency noted last week. There is an excellent demand, which at the moment is largely in excess of the production. Makers as well as dealers, appear to have considerably oversold themselves; and the high price of nitrate accentuates the position. The market has fluctuated between £12 7s. 6d. and £12 12s. 6d., less 3½ per cent. Gas liquor is quoted at 8s. 6d. to 9s. 6d.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—Continued decreasing requirements for all descriptions of round coal, with a downward tendency in prices, is the general report throughout this district; and although the output is being restricted, considerable stocks are accumulating. Few of the leading colliery proprietors have made any actually quoted reduction upon their list rates for the better qualities of round coal; but there is a very general giving way, and it is exceptional where list rates are being fully maintained. Best Wigan Arley can be bought at 11s. to 11s. 6d.; Pemberton four-feet and second qualities of Arley, at 9s. 6d. to 10s.; and the lower qualities of house coal, at 7s. 6d. to 8s. per ton. With regard to common round coal, for general manufacturing purposes, the position could scarcely be worse; and with excessive supplies offering in the market, almost any prices, ranging from 6s. and 6s. 6d. per ton at the pit mouth, are being taken to effect sales of anything like quantities. For shipment, there are sellers at as low as 7s. 6d. per ton for ordinary steam coal, delivered at the Garston Docks or the High Level, Liverpool; and the general price scarcely exceeds 8s. per ton. This exceptionally depressed condition of the round coal trade is necessarily causing a very uneasy feeling with regard to the usual contracts that will shortly come upon the market. Last year very low prices were accepted to secure contracts for locomotive fuel; and it seems more than probable that competition this season will be even still more keen, and that there will have to be a further giving way in prices. With regard to gas coal, the outlook is much the same; and there would seem every likelihood of low prices ruling. So far, however, there have been no inquiries upon the market, except a portion of the Manchester contract, which has not yet been settled, to really test the basis on which prices are likely to rest. In connection with this very unsatisfactory outlook as to prices, the possibility of some reduction in wages continues to be discussed; but want of co-operation on the part of Yorkshire still stands in the way. Engine classes of fuel are in generally active demand; and with a scarcity of supplies, owing to the restricted production of round coal, prices show a continued hardening tendency—sellers in many cases holding for 3d. to 6d. per ton above recent quotations. At the pit mouth, good qualities of burgy average 6s. 6d.; the best qualities of slack, 5s. to 5s. 6d.; and common sorts, 3s. 9d. to 4s. 3d. per ton. Should there, however, be any very material advance in slack, the exceptionally low price of common round coal will no doubt induce consumers to turn to this class of fuel, rather than pay what may be regarded as exorbitant figures for ordinary engine fuel.

Northern Coal Trade.—The coal trade of the North is now beginning to show that irregular activity that is usually known here in the

summer; the gas coal trade of Durham being depressed, and there being a larger demand for shipment for the Northumbrian steam coals, so that the collieries vary very greatly in the extent of their working. Best Northumbrian steam coal is quoted 8s. 6d. per ton f.o.b.; and the chief collieries have tolerably full work. Second-class coal is 8s. per ton; and small steam coal is steady at from 3s. 3d. to 3s. 6d. per ton. Some of the Durham collieries are now finding a marked falling off in the sales both of gas and household coals; but there is an increasing shipment from the Wear and from West Hartlepool. Gas coals vary very much in price; but from 6s. to 6s. 6d. per ton f.o.b. is the general quotation for best Durham qualities. Sales, however, continue to be made both below and, for special kinds, above that price; and contracts are now usually at or about 6s. per ton f.o.b. There is very little alteration in the coke trade. Best Durham makes are from 13s. 6d. to 14s. per ton. Gas coke is less abundant; and the output is therefore more rapidly taken up. There has been no alteration in the price in the past few weeks.

Scotch Coal Trade.—Reports from week to week are apt just now to be a little monotonous, consisting, as they do, of a record of continued depression. With the exception of ell coal, considerable quantities of which are going to Germany, there is little demand. Splint is especially stiff to sell—so much so, that some coalmasters are said to be contemplating ceasing to work it until better times return. Stocks on hand continue to grow, notwithstanding heavy restrictions upon output. The prices quoted are: Main, 5s. 9d. to 6s.; ell, 6s. 9d. to 7s.; splint, 6s. 3d.; and steam, 8s. per ton f.o.b. Glasgow. The shipments last week amounted to 150,191 tons—an increase of 22,496 tons upon the preceding week, and of 9859 upon the corresponding week of last year. Nearly all the increase was experienced at east coast ports. For the year to date, the total shipments have been 1,662,921 tons—a decrease as compared with the same period of last year of 134,535 tons.

Arbitration regarding Lands required for Water-Works Purposes at Devonport.—The Under-Sheriff of Devon (Mr. E. H. Houlditch) and a jury sat at the Duke of Cornwall Hotel, Devonport, last Tuesday, for the purpose of assessing the compensation to be paid to the Trustees of the Looseleigh Estate, Tamerton Foliott, in regard to lands taken over by the Devonport Water Company. The evidence showed that the portion of land in question was 5¼ acres in extent. The value placed upon it by two surveyors on behalf of the Trustees was £1301 12s. 6d. and £1491 10s. respectively. Witnesses on behalf of the Company put the value at from £400 to £480 5s. 6d. The jury awarded the Trustees £650. After the verdict, it transpired that the Company previously offered £800 in discharge of the claim.

The Payment of Gas Accounts under Deeds of Assignment.—The Judge of the West Kent County Court (Mr. J. Homersham Cox) has just given a somewhat important decision in a case in which the Maidstone Gas Company sued a trade valuer—Mr. J. Waghorn—for £11 18s. 10d. for gas supplied to a firm of clothiers carrying on business as Smythe Bros. at Maidstone. The point was that, the firm having made an assignment for the benefit of their creditors, the Company should come under that deed. The Company previously obtained judgment against the firm; but, on seeking to enforce the order they were met by Mr. Waghorn, who had been appointed Trustee. Mr. G. Baldwin, collector to the Company, therefore brought the matter again before the Court. It was elicited that no notice of the execution of a deed of assignment had been given to the Company, and also that the sale of the estate had realized £455 1s. 10d. In giving judgment for the Company, the Judge said this fact was fatal to the defence that the Gas Company should rank as ordinary creditors, for there were ample funds to pay them as preferential creditors.

A Gasholder in Danger.—Shortly after two o'clock last Friday morning, a fire broke out at the timber yard and workshops of Mr. D. Charteris, in Earl Street, Millbank, and progressed with such rapidity that soon after the alarm was raised a range of buildings of two and three floors, extending 60 yards in one direction and 50 yards in another, was blazing from end to end. In addition to the stand-pipes which had at first been used, 12 steamers were set to work, but with very little effect. It was not long before a very serious danger presented itself, for the gasholder in Page Street of The Gaslight and Coke Company began to be licked by the flames. It is not surprising that the news quickly spread in the neighbourhood that the holder was on fire, and would "blow up" immediately; and a remarkable scene of panic was witnessed—the entire population of the district leaving their homes, and hurrying away from the supposed danger. The Fire Brigade authorities at once set two steamers to pump on the holder and keep it cool; but the Company's officials soon drew off the gas and lowered the vessel. The premises were nearly burnt out, and the neighbouring houses are damaged.

Sales of Stock and Shares.—At Newcastle last Wednesday, Mr. Robert Mack offered for sale at the Gas Offices, Newcastle, £8000 of new consolidated stock of the *Newcastle and Gateshead Gas Company*. There was a large attendance of buyers, the bidding was brisk throughout, and the whole of the stock was disposed of. The following are the prices obtained per cent.:—£500 at £186 10s.; £500 at £186 10s.; £400 at £186 10s.; £500 at £186; £300 at £185 10s.; £500 at £185 10s.; £500 at £185 10s.; £100 at £185 12s. 6d.; £100 at £185 10s.; £200 at £185 10s.; £500 at £185 10s.; £200 at £185 10s.; £300 at £185 10s.; £500 at £185 10s.; £100 at £185 12s. 6d.; £500 at £185 10s; £410 at £185 12s. 6d.; £500 at £185 12s. 6d.; £200 at £185 12s. 6d.; £200 at £185s. 15s.; £500 at £185 15s.; and £490 at £186.——At Colchester, last Friday week, 200 £20 shares in the *Colchester Gas Company*, were sold by auction; realizing prices ranging from £28 10s. to £30. These shares will rank equally with those upon which a dividend of 7 per cent. has been paid for many years past.——Last Thursday, at Kirkham, £472 worth of "B" stock in the *Fylde Water Company* produced from £19 10s. to £20 5s. per £10 lot.——The following shares in the *Rochester, Chatham, &c., Gas Company* were sold last Tuesday at Chatham: Three "B" shares (7 per cent.) of £12 30s. each, fully paid, at £19 17s. 6d. per share; three similar shares, at £19 15s. each; nine "C" shares (£3 6s. 8d. paid) at £5 5s. per share.

The Transfer of the Barry and Cadoxton Gas and Water Works to the Local Board.—A meeting of the shareholders of the Barry and Cadoxton Gas and Water Company was held yesterday week, at which a resolution was unanimously passed approving of the Bill now before Parliament to authorize the acquisition of the gas and water works by the Local Board. Two or three of the shareholders expressed the opinion that they were making a great sacrifice.

Coal-Conveying Plant in Gas-Works.—We learn that the plant supplied by the New Conveyor Company, Limited, for the new retort-house at the Burnley Corporation Gas-Works is doing its work very efficiently. Steel chain and steel rope conveyors are fitted on the different sides of the house; thus affording gas engineers an opportunity of seeing each of the latest forms of conveyors in operation side by side. Similar plant has been erected at the Leigh Corporation Gas-Works, the Engineer of which (Mr. A. T. Fletcher) states that it is working to his entire satisfaction.

A Strike at the Buckingham New Water-Works.—A strike, which at times assumed somewhat serious aspects, occurred at Buckingham last week, at the new borough water-works, which Mr. Hill, of Maidenhead, is constructing. Fault, it appears, was found with the amount of work done by one gang of men. The gang struck, and visited the other men—calling them off work. Those who refused to leave were pelted with stones and other missiles. The strikers marched through Buckingham, shouldering pickaxe and shovel, and assailing with stones and dirt the men working in the trenches. One striker was arrested for assault. It seems that the men have been receiving 3s. a day for ten hours' work. They now demand an extra 6d. per day. The contractor has offered an extra 3d.; and this some of the men have accepted.

Water Affairs at Worcester.—The Worcester City Council have agreed to a resolution of the Water and Sewerage Committee in favour of permitting the International Water and Sewage Purification Company to provide and lay in one of the filters at the water-works a sufficient quantity of polarite to convert it into a sand and polarite filter for an 18 months' trial free of cost, on condition that the Council had the option, at the expiration of that time, to purchase the material for £430. They have also accepted a recommendation of the same Committee to rescind a resolution passed in August last (noticed in the JOURNAL at the time) as to the construction of a reservoir on Elbury Hill, and other works at a cost of £1961; and, provided the Local Government Board will sanction the necessary loan, to improve the supply of water to the higher levels of the City at a cost of £9203. The Local Government Board will be asked to cancel their sanction to the borrowing of the above-mentioned £1961.

The Purchase of the Local Electric Lighting Works by the Taunton Corporation.—On behalf of the Local Government Board, Mr. Thomas Codrington, M.Inst.C.E., held an inquiry at Taunton last Wednesday, into the application of the Town Council for permission to borrow the sum of £16,000, for the purpose of purchasing from the Electric Lighting Company their plant and machinery, and also for making additions and improvements. The Town Clerk (Mr. Meyler) stated that about 3¼ miles of streets were at present lit by electricity; and it was proposed to put the whole of the wires underground. Several witnesses were called, who spoke with satisfaction of the electric light; but objection was made by Dr. Penny, on the ground of the annoyance caused to the inhabitants in the vicinity of the works by smoke, steam, and vibration. The Borough Surveyor explained that this would be remedied, as the Council, if they took over the works, would purchase a smoke annihilator, and reset the engines.

Proposed Extension of the Bradford Corporation Electricity Supply.—A special meeting of the Gas and Electricity Supply Committee of the Bradford Town Council has been held, to consider the advisability of extending the electricity works in readiness for next winter. Alderman F. Priestman said that the principal problem which presented itself was whether it would be best to extend the plant on the two-wire system, or to begin afresh with the three-wire system. It appeared from a report prepared by the Electrical Engineer to the Corporation (Mr. S. W. Baynes) that, to double the present two-wire mains, would cost £9630, and that the cost of the three-wire system would be £5970. There would also be a saving in working expenses on the latter system of £424. Numerous applications for light had had to be put off; and, to meet the demand for next winter, he estimated that from 200 to 300 additional generating horse power would be required. A Sub-Committee was appointed to go into the whole question, and report to a subsequent meeting.

The Suggested Purchase of the Mexbro' Water-Works by the Local Board.—In view of the proposed acquisition by the Mexbro' Local Board of the Water Company's property, Mr. A. F. Phillips, of Westminster, has been called in to examine the works and plant. His report was forwarded to the Board last week; and in it he states that, while it is not possible to entertain the purchase as a source of revenue to the town, for reducing the rates by means of a surplus profit, after paying interest and redemption fund, it certainly appears desirable for the welfare and health of the inhabitants. Considering the strong position held by the Company, and the fact that, although they are compelled to supply the district, the works are in an unsatisfactory condition, it does seem, says Mr. Phillips, most desirable that the undertaking should be transferred to the Local Authority. The quantity of water supplied to the district varies from 74,000 gallons in the winter to 100,000 gallons in the summer; but, if proper pumping machinery is employed, more than double this volume of water might be raised with a less consumption of fuel. At present there is only one set of pumps for raising the water from the well; and, in the event of an accident to them, the district would be left without water. New machinery is recommended, and also a new well. Assuming the probable purchase at £10,000, Mr. Phillips says the amount of capital required would be £13,140; but, having in view the possibility of an additional filter-bed, &c., it is advisable to provide a capital of not less than £14,000. Possibly, under the Local Board, the expense of administration may be less. The water-rental shows a steady increase of about 6 per cent. per annum; but he advises the Board to offer an amount under £10,000 for the purchase.

The Cost of Public Lighting at Bury.—At the meeting of the Bury Town Council on the 12th inst., the Watch and Park Committee, who have charge of the public lighting, submitted for confirmation a resolution requesting the Gas Committee to supply gas for the public lamps at or about cost price. Alderman Firth, the Chairman of the Gas Committee, suggested that it would be better to consider the question of reducing the price of gas all round, for this would, he said, encourage the consumption. Mr. Taylor, the Chairman of the Watch and Park Committee, urged that consideration should be given to the resolution, on the ground that the Committee were large consumers. He pointed out that the Committee now lighted the public lamps all the year round, and during the past year they erected a number of additional lamps, besides replacing many of the old one-light lamps with two-light lamps. A further extension of the lighting was in contemplation; and these he thought were reasons why the price should be reduced. Alderman Firth rejoined that the Watch and Park Committee appeared to be very liberal in the matter; but they seemed to want another Committee to bear the cost. After further discussion, the recommendation to the Gas Committee was adopted.

Death Resulting from Poisoning by Coal Gas.—At Paddington, on the 15th inst., Dr. G. Danford Thomas held an inquiry concerning the death of John William Wait, aged 45, a gas-fitter, lately residing at West Hampstead. The son of the deceased said that, when he returned home on Saturday morning, the 25th ult., after sleeping at a friend's house, he discovered a considerable escape of gas in the bedroom of his parents, and found them lying unconscious on the bed. He called assistance; but they were then apparently dying. Witness found that the escape was from a gas-bracket attached to the wall. The man was removed to St. Mary's Hospital, Paddington, where he remained unconscious three days, and never thoroughly recovered. He lived 19 days. Dr. Broadbent, Resident Surgeon at the hospital, said the immediate cause of death was softening of the brain, following poisoning by coal gas. Other evidence showed that Mrs. Wait, who was not removed to the hospital, was more or less insensible for a week. Police-constable Summerhays stated that the escape was due to the absence of a stop-pin to the burner-tap. The Coroner said it rarely happened that the medical faculty had an opportunity of watching the continuous effects of coal-gas poisoning, as in these cases the persons were invariably found dead. In the present instance, the poison had permeated the whole system; and softening of the brain had ensued. The jury returned a verdict of "Accidental death."

The Water Supply of Temple Newsam.—Our readers may remember that on the 25th ult. Mr. Justice North made an order restraining Mrs. Meynell-Ingram from cutting off, without reasonable notice, the water supply to the inhabitants of Temple Newsam and Halton (see *ante*, p. 599). Against this order the defendant at once appealed; and the matter was down for hearing on the 11th inst. Sir H. James, Q.C., addressing Lords Justices Lindley and Kay, said he and his learned friend, Mr. Hall, Q.C., appeared for Mrs. Ingram, and he asked their Lordships' consent to a course which he had suggested to the learned Counsel on the other side (Mr. Cozens Hardy, Q.C.) as best to be pursued in the interests of all parties. The appeal read before the Court simply raised the point of law, whether there was or was not a legal contract. The condition of affairs was this: An inquiry into the water supply of the district was about to be held by the Local Government Board; and as those who advised Mrs. Ingram, and the lady herself, were desirous that the best possible should be done in the interest of the cottagers, he (Sir Henry James) had suggested to Mr. Cozens Hardy that the appeal should stand over until after the inquiry had been held. In the meantime, the water supply would not be cut off. Mr. Cozens Hardy thought the proposition a very fair one, but hoped that there would be no delay in the holding of the inquiry. The appeal was ordered to stand over generally, with liberty to either party to have it restored to the paper.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 724.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	13 Apl.	10½	Alliance & Dublin 10 p. c.	10	16¼–17⅛*	..	6 0 0
100,000	10	,,	7⅞	Do. 7 p. c.	10	12–13*	..	5 15 5
300,000	100	3 Jan.	5	Australian (Sydney) 5 % Deb.	100	104–106	..	4 14 2
100,000	20	30 Nov.	8	Bahia, Limited	20	11–12	..	13 6 8
200,000	5	16 Nov.	6¼†	Bombay, Limited	5	5⅞–6⅛	..	5 4 0
40,000	5	,,	6¼†	Do. New	4	4–4⅛	..	5 15 6
380,000	Stck.	24 Feb.	11½	Brentford Consolidated	100	215–219	..	5 5 0
180,000	,,	,,	8½	Do. New	100	168–173	..	4 18 3
220,000	20	15 Mar.	11½	Brighton & Hove Original	20	41–43	..	5 6 11
888,500	Stck.	31 Aug.	5	Bristol	100	104–107	..	4 13 5
320,000	20	13 Apl.	11½	British	20	42–44*	+1	5 4 7
50,000	10	15 Mar.	11½	Bromley, Ordinary 10 p. c.	10	19–20	..	5 15 0
51,510	10	,,	8⅝	Do. 7 p. c.	10	14⅝–15⅜	..	5 9 8
328,750	10	—	—	Buenos Ayres (New) Limited	10	5⅜–6⅛	..	—
200,000	100	3 Jan.	6	Do. 6 p. c. Deb.	100	98–100	..	6 0 0
250,000	20	24 Feb.	8	Cagliari, Limited	20	25–27	..	5 18 6
550,000	Stck.	14 Oct.	12½†	Commercial, Old Stock	100	247–252	..	4 19 2
165,000	,,	,,	9½†	Do. New do.	100	187–192	..	4 18 11
160,762	,,	15 Dec.	4½	Do. 4½ p. c. Deb. do.	100	127–132	..	3 8 2
800,000	Stck.	15 Dec.	13	Continental Union, Limited	100	234–239	+3	5 8 9
200,000	,,	,,	10	Do. 7 p. c. Pref	100	190–195	..	5 2 7
75,000	Stck.	15 Mar.	10	Crystal Palace District	100	187–192	..	5 4 2
486,090	10	27 Jan.	10	European, Limited	10	21½–22½	+½	4 8 11
354,060	10	,,	10	Do. Partly paid	7½	14½–15½	..	4 17 0
5,596,560	Stck.	10 Feb.	12	Gaslight & Coke, A, Ordinary	100	220–225	..	5 6 8
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	95–99	..	4 0 10
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	262–267	+2	3 15 0
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	115–120	..	4 3 4
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	165–170	..	4 8 2
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	100	167–171	..	4 1 10
463,000	,,	,,	10	Do. I, 10 p. c. Prf.	100	260–265	..	3 15 6
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	100	155–159	..	3 15 6
1,061,130	,,	15 Dec.	4	Do. 4 p. c. Deb. Stk.	100	124–128	..	3 2 6
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	130–134	..	3 7 2
908,000	,,	,,	6	Do. 6 p. c. do	100	169–173	..	3 9 4
3,800,000	Stck.	16 Nov.	12	Imperial Continental	100	228–231	..	5 3 10
75,000	5	30 Nov.	6	Malta & Mediterranean, Ltd.	5	4½–5	..	6 0 0
560,000	100	4 Apl.	5	Met. of Melbourne, 5 p. c. Deb.	100	105–107	..	4 13 4
541,920	20	16 Nov.	5	Monte Video, Limited	20	13½–14½	..	6 18 0
150,000	5	30 Nov.	10	Oriental, Limited	5	7⅞–8½	..	6 1 2
60,000	5	29 Mar.	7	Ottoman, Limited	5	4–4⅛	..	7 7 4
166,870	10	—	2	Pará Limited	10	2–2½	..	—
420,000	100	2 Nov.	6	People's Gas of Chicago— 1st Mtg. Bds.	100	103–107	..	5 12 1
500,000	100	1 Dec.	6	2nd Do.	100	100–105	..	5 14 3
150,000	10	—	10	San Paulo, Limited	10	9–10	..	—
500,000	Stck.	24 Feb.	15½	South Metropolitan, A Stock	100	290–295	..	5 5 0
1,350,000	,,	,,	12	Do. B do.	100	240–245	..	4 17 11
230,030	,,	,,	13	Do. C do.	100	245–250	..	5 4 0
750,000	,,	13 Jan.	5	Do. 5 p. c. Deb. Stk.	100	148–152	+3	3 5 9
60,000	Stck.	15 Mar.	11½	Tottenham & Edm'nton, "A"	100	225–230	..	5 0 0
				WATER COMPANIES.				
744,897	Stck.	30 Dec.	10	Chelsea, Ordinary	100	262–266	..	3 15 3
1,720,252	Stck.	29 Mar.	8	East London, Ordinary	100	210–214	..	3 14 10
544,440	,,	30 Dec.	4½	Do. 4½ p. c. Deb. Stk.	100	142–145	..	3 2 1
700,000	50	15 Dec.	8½	Grand Junction	50	110–113	..	3 15 2
708,000	Stck.	10 Feb.	11	Kent	100	278–283	..	3 17 9
1,043,800	100	30 Dec.	9½	Lambeth, 10 p. c. max.	100	241–246	+3	3 17 3
406,200	100	,,	7⅞	Do. 7½ p. c. max.	100	197–202	..	3 14 6
285,000	Stck.	29 Mar.	4	Do. 4 p. c. Deb. Stk.	100	120–132	..	3 0 7
500,000	100	10 Feb.	12½	New River, New Shares	100	326–331	..	3 13 3
1,020,000	Stck.	27 Jan.	4	Do. 4 p. c. Deb. Stk	100	133–137	..	2 18 5
902,300	Stck.	15 Dec.	6½	S'thwk & V'xhall, 10 p. c. max.	100	163–168	..	3 17 4
126,500	100	,,	6½	Do. D 7½ p. c. do.	100	145–150	..	4 6 8
1,155,066	Stck.	15 Dec.	10	West Middlesex	100	260–265	..	3 15 6

*Ex Div.

† Next dividend will be at this rate.

GWYNNE & BEALE'S PATENT GAS EXHAUSTERS AND ENGINES.

Telegrams: "GWYNNEGRAM LONDON." **GWYNNE & CO.,** TELEPHONE No. 2698.

HYDRAULIC AND GAS ENGINEERS, BROOKE STREET WORKS, HOLBORN, LONDON, E.C.

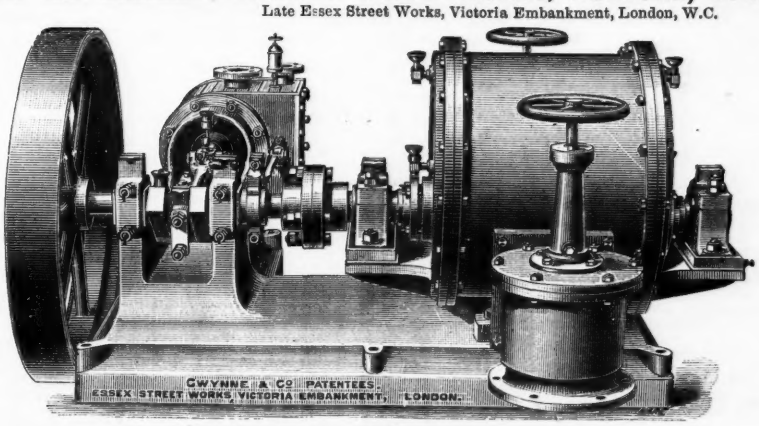
Late Essex Street Works, Victoria Embankment, London, W.C.

Thirty-three Medals at all the Great International Exhibitions have been awarded to GWYNNE & Co., for Gas Exhausters, &c.

They have never sought to make price the chief consideration, but to produce Machinery of the very highest quality.

The result is that in every instance their work is giving the fullest satisfaction.

They have completed Exhausters to the extent of 30,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work, and can be referred to.



Engine and Exhauster Combined on One Bed-Plate.

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Catalogues and Testimonials sent on Application.

Their Exhausters can be made, when desired, on their New Patent Principle, to pass Gas without the slightest oscillation or variation in pressure.

NO OTHER MAKER CAN DO THIS.

Makers of GAS-VALVES HYDRAULIC REGULATORS VACUUM GOVERNORS STEAM-PUMPS for Tar Liquor, or Water; PATENT SELF SEALING AND CLEANSING RETORT-LIDS AND MOUTHPIECES; CENTRIFUGAL PUMPS and PUMPING ENGINES specially adapted for Water-Works raising Sewage, &c.

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JOHN WM. O'NEILL, Managing Director.

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ANDREW STEPHENSON, Agent.
Please address all communications to the Company, as above.

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THE Engineer of a large Provincial Gas-Works wishes to RECOMMEND a reliable, steady MAN, to take charge of a Small Works, making from 3 to 4 million cubic feet annually.
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WANTED, a Situation as Manager of a Tar Distillery, at either a Gas-Works or Private Yard. Advertiser has a thorough practical knowledge of every branch of Tar Distilling and Ammonia Making. Could undertake erection of a new plant.
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A WELL-CONDUCTED Youth, about 16 years of age, having just left School, being anxious to obtain employment, would be glad to hear of anything in which his Services could be made available. Is a good French Scholar, both as to speaking and writing, having two Preceptor's Certificates to that effect and a Cambridge Local (Junior), a good Arithmetician, and, age considered, fairly well up in Shorthand and Geometrical Drawing.
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WANTED, a good Fitter, competent to lay Mains and Services, fix Meters, take Indices, and do the routine Fitting and rough Smithing Work required in a Gas-Works. Constant employment to a suitable Man.
Apply with references, stating age and wages required, to Mr. E. JONES, Gas Manager, New Mills, STOCKPORT.

WANTED, a Stoker. Eight-hour shifts four months, wages 26s.; twelve-hour Shifts eight months, wages 25s. During twelve-hour shifts, one Sunday per month off; leaving off at 4 o'clock on Saturdays, or, if required to stop on, 1s. extra. If Purifiers are taken out by night, 1s. extra each. No charging on Sundays in the height of Summer. Any overtime, 6d. per hour. Constant job.
Apply to J. TALL, Manager, Gas-Works, DARTMOUTH.

CARDIFF GASLIGHT AND COKE COMPANY.

WANTED, a Works Manager at the Company's Grangetown Station. Salary commencing at £200 per annum, with House, Coal, Gas, &c., free.
Applications, stating age and experience, accompanied by *copies* of not more than three recent Testimonials, to be sent in by Thursday, May 4, 1893, to Mr. H. Morley, the Engineer, and endorsed "Works Manager."

By order,
GEORGE CLARRY,
Secretary.

Cardiff, April 12, 1893.

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*** See Advertisement p. II., centre of JOURNAL.
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First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
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TUBES and Fittings for Gas, Steam, and Water, in stock to 8 inches diameter; Iron and Steel Ascension-Pipes.
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WANTED (immediately), by the Trustees for the District and Harbour of Maryport, as MANAGER of their Works, a competent Man thoroughly acquainted with the Manufacture and Distribution of Gas, and the Manufacture of Sulphate of Ammonia. Preference given to a practical Gas Maker.
List of duties, &c., on application.
Salary, £90 per annum, with free House, Firing, and Light.
Canvassing disqualifies.
Applications, in own handwriting, stating age (not to exceed 50 years), experience, &c., with not more than four testimonials of recent date, received up till Noon, on Monday, the 1st of May next.
Address Mr. F. KELLY, Clerk to the Trustees, MARYPORT.

WANTED, Gas Liquor.
Address GEORGE DOBSON, LIMITED, CARDIFF.

WANTED, two second-hand Purifiers, about 6 feet square, in good repair, with Valves and Connections complete.
Reply, with price and particulars, to A., care of J. P. Clarkson, Esq., 5, GREAT WINCHESTER STREET, E.C.

WANTED, 100,000 to 200,000 gallons of CREOSOTE, for delivery over the next Twelve Months. Gravity, 1030 to 1050.
Address, stating lowest price, No. 2226, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE—Purifier Valve, eight-way (6-inch), by Cockey, Frome, in good condition.
METERS, second-hand, two and three light; surplus stock.
Apply to the SECRETARY, Gas Company, Solihull, WARWICKSHIRE.

FOR SALE—A perfectly new 20,000 cubic feet per hour EXHAUSTER, with Steam-Engine combined, including Hydraulic Gas Governor, Bye-Pass Valves, and Connections.
For further particulars, apply to Mr. T. G. MARSH, 41, Corporation Street, MANCHESTER.

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A GAS Company in South Wales offer 2000 tons of good, clean COKE BREEZE FOR SALE, delivered f.o.b., or on Rail, at 2s. per ton (21 cwt.)
Apply, by letter, to No. 2223, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE—(1) Combined Engine and EXHAUSTER, with Compensating Hydraulic Governor (Laidlaw); passes 7500 cubic feet per hour.
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The above are being displaced, in consequence of extensions, and can be seen at the Gas-Works, Portobello, N.B.

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Manager and Secretary.

IRISH BOG ORE OXIDE OF IRON.

GAS PURIFICATION.

BALE & CO., direct Importers from Ireland. Sample and Price on application.
OXIDE PAINT, SULPHURIC ACID, & Chemicals.
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OXIDE OF IRON.

FINEST Quality of Natural Bog Ore.
Particulars and price, apply to Mr. T. L. ARCHER, 20, Fennel Street, MANCHESTER.

MESSRS. DEBENHAM, TEWSON, FARMER, and BRIDGEWATER'S MONTHLY LIST of Shops, Show-Rooms, Factories, and Waterside Premises, suitable for the Exhibition and Manufacture of Engineering and other Appliances, may be obtained, free of charge, at their Offices, 80, CHEAPSIDE, E.C.

SADLER AND CO., LIMITED, MIDDLESBROUGH; ULVERSTON (BARROW); PORTSMOUTH; CARLTON; STOCKTON; 315, St. Vincent Street, GLASGOW; 10, Marsden Street, MANCHESTER; and 85, Water Street, NEW YORK. Tar Distillers, Manufacturers of all TAR PRODUCTS, ALIZARINE and other TAR COLOURS, BICHROMES, OXALIC ACID, ALKALIES, LIQUOR AMMONIA, AMMONIA, SULPHATE, &c.
Head Office: MIDDLESBROUGH. Correspondence invited.

LIQUOR and Tar wanted.
BROTHERTON AND CO., Ammonia and Tar Distillers, LEEDS and WAKEFIELD.

FOR SALE, at the Barnsley Gas-Works—
Four 12 feet square PURIFIERS, with Centre-Valve, Connections, &c.
The above are in good condition, and may now be seen at work; only being sold to make room for larger.
For further particulars, apply to
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Manager.

THE Southampton Gaslight and Coke Company have FOR DISPOSAL, and taken apart ready for removal by Rail or Water, the SIDE and BOTTOM PLATES of a Cast-Iron GASHOLDER TANK, about 61 feet diameter by 18 feet deep. Weight about 125 tons. Makers, Westwood and Wright. To be removed at Purchaser's own risk.
May be viewed on application to Mr. S. W. DURKIN, Manager, Gas-Works, SOUTHAMPTON.

RUSHDEN AND HIGHAM FERRERS DISTRICT GAS COMPANY, LIMITED.

IN consequence of the Amalgamation of the Rushden and Higham Ferrers Gas Companies, and the erection of entirely new Works, the Directors of the above Company have the following PLANT FOR SALE:—
One TWO-LIFT GASHOLDER. Outer Lift, 35 ft. by 15 ft.; inner do., 33 ft. 6 in. by 15 ft.
One SINGLE GASHOLDER, 35 ft. by 12 ft.
One TWO-LIFT GASHOLDER, 30 ft. by 20 ft.
SCRUBBER.
PIPE and ANNULAR CONDENSERS.
PURIFIERS.
STATION METERS.
RETORT IRONWORK, HYDRAULIC MAINS.
Various VALVES and CONNECTIONS.
For particulars and permission to view, apply to JNO. T. LEWIS, Engineer, Gas-Works, WELLINGBOROUGH.

HARTLEPOOL GAS AND WATER COMPANY.

TO IRONFOUNDERS, ETC.

THE Directors of the above Company are prepared to receive TENDERS for the supply and erection of RETORT-BENCH MOUNTINGS, COAL-HOPPERS, STOREAGE TANKS, &c., required for a Bed of Inclined Retorts.
Plans and Specification may be seen, or any further Information obtained, on application to the Company's Engineer, Mr. Thomas Bower, who, if desired, will supply copies of the Plans.
Tenders, on form prescribed and sealed and endorsed "Tender for Retort-Bench Mountings," to be sent to Mr. Thomas Trewhitt, Secretary, Gas and Water Company, West Hartlepool, not later than Wednesday, the 10th day of May next.
The Directors do not bind themselves to accept the lowest or any tender.

THOMAS TREWHITT,
Secretary.

West Hartlepool,
April 20, 1893.

FARNHAM GAS COMPANY, LIMITED.

TENDERS FOR COAL.

THE Directors of the Farnham Gas Company, Limited, are prepared to receive TENDERS from Persons willing to supply and deliver free of all Dues and Charges, at the Farnham Station, London and South-Western Railway, 1900 tons of the following descriptions of GAS COAL—viz., New Pelton, Pelaw Main, Aldwarke Main, or Strafford Silkstone—to be delivered in quantities of 50 tons (at intervals) before the 31st of March, 1894. The Coals to be consigned to the order of the Farnham Gas Company, Limited, at the Farnham Railway Station.
In the case of Seaborne Coal, the Meter's Certificate of each quantity to be duly sent with Invoice of same.
Payment monthly, two days after the ordinary meeting of the Directors.
Sealed tenders, marked "Tender for Coal," to be delivered to the Secretary, Mr. W. Wells, 112, West Street, Farnham, Surrey, not later than Eleven o'clock a.m., on Monday, the 1st of May, *of whom Forms of Tender may be obtained.*
The Directors reserve the right to reject the lowest or any tender.
April 18, 1893.

THE Devonport Gas and Coke Company invite TENDERS for 16,000 tons, or less, of unscreened NEWCASTLE or DURHAM GAS COAL.

Tenders addressed, to the Chairman, Gas and Coke Company, Devonport, and endorsed "Tender for Coal," to be sent in on or before the 6th prox.

Specifications may be had on application.

JOHN WILLIAMS,
Secretary.

April 22, 1893.

THE Middleton Corporation invite TENDERS for a PURIFYING-HOUSE, with Iron Roof, at their Gas-Works, Middleton.

Plans and Conditions may be seen, and Specification obtained, on application to Mr. T. Duxbury, Gas Manager, Middleton, on and after the 4th of May next.

Tenders, addressed to the Chairman of the Gas Committee, and endorsed "Purifying-House," to be delivered at my Office on or before the 17th of May next.

FREDERICK ENTWISTLE,
Town Clerk.

Town Hall, Middleton,
Near Manchester, April 21, 1893

TENDERS FOR GAS COALS.

THE Directors of the Ramsey Gas Company (Huntingdonshire) invite TENDERS for the supply of 350 tons of best GAS COALS, to be delivered during the ensuing Twelve Months, in quantities monthly as may be required.

Tenders, stating price per ton of 21 cwt., delivered free at Ramsey (G.N. or G.E.) Stations, to be sent to the undersigned on or before the 1st of May next.

The Directors do not bind themselves to accept the lowest or any tender.

WILLIAM ORRISS,
Secretary.

Ramsey, April 19, 1893.

WIRKSWORTH GASLIGHT AND COKE COMPANY, LIMITED.

TENDERS FOR COAL.

THE above Company are prepared to receive TENDERS for about 700 tons of screened GAS COAL, delivered free at the Wirksworth (Midland) Railway Station in such quantities as the Manager may from time to time direct.

The Coal must be fresh wrought, and free from Impurities.

Tenders, stating price per ton of 21 cwt., and from what seam wrought, to be sent to the Chairman, T. Newton, Esq., on or before May 2, endorsed "Tender for Coal."

JAMES LEE,
Secretary.

Gas-Works, Wirksworth,
April 22, 1893.

BOROUGH OF WIDNES.

TO GASHOLDER MAKERS.

THE Widnes Corporation are prepared to receive TENDERS for a THREE-LIFT TELESCOPIC GASHOLDER, having a total capacity of 650,000 cubic feet.

Plans may be inspected, also Copies of Specification and Conditions of Contract obtained, on application to Isaac Carr, Assoc.M.Inst.C.E., Gas-Works, Widnes.

Tenders, endorsed "Gasholder," must be addressed to the Chairman of the Gas and Water Committee, and delivered to the undersigned at the Town Hall, Widnes, not later than Noon on Tuesday, May 2, 1893.

The Corporation do not bind themselves to accept the lowest or any tender.

H. S. OPPENHEIM,
Town Clerk.

Town Hall, Widnes,
April 18, 1893.

SEVENOAKS GAS COMPANY.

TENDERS are invited by the Directors of the Sevenoaks Gas Company for the ERECTION of two additional BEDS OF RETORTS, with the necessary Ascension-Pipes, Hydraulic Main Connections, &c., and also for the RENEWAL of two BEDS in the existing Stack, at their Works, Otford Road, Sevenoaks.

Drawings can be inspected at the Works, and Copies of Specification had, on payment of half-a-guinea, which will be returned if a *bonâ fide* tender is sent in.

Sealed tenders, addressed to the Chairman, William Hughes, Esq., must be received at the Company's Office, 88, High Street, Sevenoaks, by not later than Wednesday, May 10, 1893.

The Directors do not bind themselves to accept the lowest or any tender.

By order,
HENRY HOW,
Secretary.

Gas Office, Sevenoaks,
April 24, 1893.

SEVENOAKS GAS COMPANY.

THE Directors of the Sevenoaks Gas Company desire to receive TENDERS for 5000 tons of GAS COAL, to be delivered from May, 1893, to March, 1894, at the Bat and Ball Station (L. C. & D. Railway), Sevenoaks.

The contract will be divided into quantities of not less than 1000 tons, and preference given to the Districts of Durham, Newcastle-on-Tyne, and South Yorkshire.

Forms of Tender may be had on application to the Secretary; and the tenders themselves must reach the Company's Office, 88, High Street, Sevenoaks, addressed to William Hughes, Esq., Chairman, on or before Wednesday, May 10, 1893.

The Directors are not bound to accept the lowest or any tender.

By order,
HENRY HOW,
Secretary.

Gas Office, Sevenoaks,
April 24, 1893.

TENDERS FOR GAS COAL.

THE Directors of the Oakengates and St. George's Gas Company invite TENDERS for the supply of 1600 or 1700 tons of the best screened GAS COAL, delivered free at the Oakengates Station in such quantities as may be required between June 30, 1893, and June 30, 1894.

Tenders, endorsed and accompanied by an Analysis of the Coal offered to be sent in on or before May 13, 1893.

The Directors do not bind themselves to accept the lowest or any tender.

GEO. PARKER,
Manager.

April 22, 1893.

TENDERS FOR GAS COALS.

THE Brentwood Gas and Coke Company invite TENDERS for the supply of about 3000 tons of screened GAS COALS in Trucks at the Pit, or, delivery at the Brentwood Railway Station (G.E.R.) in quantities as may be required, from the 8th day of May next to the 30th day of April, 1894.

Tenders (with analysis of the Coals to be supplied), and terms for cash payments, to be sent to the undersigned on or before the 29th inst.

The Directors do not bind themselves to accept the lowest or any tender.

C. A. FIELDER,
Secretary.

Brentwood, April 15, 1893.

TO COAL MERCHANTS, SHIP OWNERS, AND OTHERS.

THE Directors of the Torquay Gas Company are prepared to receive TENDERS for the supply of about 13,000 tons of best approved GAS COAL, to be delivered before the 1st of May, 1894.

Further Particulars and Forms of Tender to be obtained from Mr. Beynon, the Engineer of the Company, Hollacombe, Paignton; and tenders to be sent to the undersigned, on or before the 6th of May next.

The lowest tender not necessarily accepted; and the Directors reserve the right to accept part of any tender.

By order,
JOHN KITSON,
Secretary.

Torquay, April 20, 1893.

TENDERS FOR GAS COALS.

THE Directors of the Exmouth Gas Company are prepared to receive TENDERS for the supply of 2000 tons of screened or unscreened fresh wrought GAS COALS.

Tenders to be for price f.o.b. and c.i.f. at Exmouth Docks, between the 1st of July next and the 30th of June, 1894, accompanied by Working Analysis.

Sealed tenders, addressed to the Chairman, and endorsed "Tender for Coal," to be sent in not later than the 1st day of May, 1893.

The Directors do not pledge themselves to accept the lowest or any tender.

By order,
JAMES T. FOSTER,
Secretary.

April 13, 1893.

CHIGWELL, LOUGHTON, AND WOODFORD GAS COMPANY.

THE above Company are prepared to receive TENDERS for One, Two, or Three Years for the supply of 3600 tons per annum of the best screened GAS COALS, to be delivered at Woodford (Essex) Station, free of all charges, in quantities of 300 tons per month.

Tenders to be sent to the Offices of the Company, addressed to the Chairman, not later than the 10th of May next.

The lowest or any tender not necessarily accepted.

By order,
E. J. HOLWELL,
Secretary.

Snake's Lane, Woodford, Essex,
April 22, 1893.

INNERLEITHEN GASLIGHT COMPANY.

COAL.

THE Directors of the Innerleithen Gaslight Company invite TENDERS for the supply of 500 tons (more or less) of first-class CANNEL, and 600 tons (more or less) of third-class CANNEL COAL for the Year from the 1st of May next.

Offers must include carriage to Innerleithen Station.

Analysis must accompany offers.

TAR AND AMMONIACAL LIQUOR.

The Directors invite TENDERS for the purchase of the whole TAR and AMMONIACAL LIQUOR produced at their Works for the Year from the 1st of May next.

The Purchaser must provide Waggon-Tanks.

Average quantity produced, 170 tons.

All offers to be sent not later than the 29th inst. to

WILLIAM STORIE,
Secretary.

Innerleithen, April 19, 1893.

Fcap. 4to, Cloth, price 7s. 6d., post free.

Practical Photometry.

By William Joseph Dibdin, F.I.C., F.C.S.,

London: WALTER KING, 11, Bolt Court, FLEET ST., E.C.

ROBERT MARSHALL,
CANNEL COAL MERCHANT,
97, WELLINGTON STREET, GLASGOW.

Prices and Analysis of all the Scotch Cannels on application

NEW **BOX'S** PATENT
RETORT LID-FASTENER.
CANNOT GET OUT OF ORDER.
DOES NOT DAMAGE LIDS.
SIMPLE & EFFECTIVE—CHEAP & DURABLE.
For Prices and Particulars, apply to
W. W. BOX, Gas-Works, Crayford, Kent.
(Illustrated Description in JOURNAL, Vol. LX., p. 346.)

NOTICE OF REMOVAL.

TO GAS ENGINEERS & MANAGERS.
CROWTHER BROS.,
Contractors for Retort Setting, Erection of Gas Apparatus, and General Repairs, **have removed from 384, Mile End Road, to**
152, TEVIOT ST., ST. LEONARD'S ROAD,
POPLAR, LONDON, E.

MEIKLEJOHN'S PATENT
Improved Slide-Valve Anti-Dip.
Is perfectly reliable in action, and requires no attention. Has all the advantages of the Dip and Anti-Dip combined.
Is cheap and easily fixed to any form of main.
Will be found the most efficient appliance of the kind yet introduced.
Further particulars and price from
C. MEIKLEJOHN,
GAS-WORKS, RUGBY.
(Late N. MEIKLEJOHN, Longwood.)

LONDONDERRY GAS COALS
FROM THE
MARQUIS OF LONDONDERRY'S COLLIERIES,
COUNTY OF DURHAM.
Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by
Mr. John Pattinson, F.C.S., F.I.S.
FOR PRICES AND PARTICULARS, APPLY TO
S. J. DITCHFIELD,
SEAHAM HARBOUR, COUNTY OF DURHAM.

COKE BREAKERS,
PRICES REDUCED.
(THOMAS & SOMERVILLE'S PATENT.)
New Design, with two Cutting Rollers, making less Breeze than their old pattern.
For Exhauster Advertisement, see last week.
GEORGE WALLER & CO.,
PARK STREET, SOUTHWARK, E.C.,
And at STROUD, GLOUCESTERSHIRE.

HOLMSIDE GAS COALS.
(Wrought out of Holmside and South Moor Collieries.)
PRESENT production over 3200 tons per working day. Area of coal about 5000 acres, including the largest remaining workable proportion of pure HUTTON SEAM GAS COAL. Analysis of HOLMSIDE GAS COAL *in bulk as shipped* gives 10,500 cubic feet of Gas per ton, of an Illuminating Power of 16¼ candles. The Sulphur is about 1 per cent., and the Ash 1¾ per cent. The Coal cokes well, and leaves about 70 per cent. of excellent Coke. To show the progress of HOLMSIDE COALS, it may be mentioned that the quantity carbonized by the London Gas Companies in 1885 was about 200,000 tons; whereas the present consumption of HOLMSIDE COALS in London alone is at the rate of over
400,000 Tons per Annum.
Full particulars on application to
MR. MARK ARCHER,
HOLMSIDE AND SOUTH MOOR OFFICES,
NEWCASTLE-ON-TYNE.

NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO

THE LOTHIAN COAL COMPANY,

LIMITED,

NEWBATTLE COLLIERIES,

DALKEITH, N.B.

CAST-IRON PIPES

FOR GAS AND WATER.

Pipes, One to Six inch Bore, kept in Stock. Also a very large assortment of all sizes of Bends, T-pieces, and Specials ready for despatch on receipt of Order.

VALVES

FOR GAS, WATER, AND STEAM.

TELEGRAMS: "PIPES GLASGOW."

WM. MACLEOD & CO.,

56, ROBERTSON STREET, GLASGOW.

BOLDON GAS COALS.

Worked by THE HARTON COAL CO., LTD.,

Output about 3000 tons per day.

ANALYSIS—

Yield of Gas per ton . .	10,500	Cubic Feet.
Illuminating Power . .	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Commercial Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Ipswich Gaslight Company, Devonport Gas Company, Newcastle Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

For prices, &c., apply to the

HARTON COAL COMPANY,

LIMITED,

Newcastle-on-Tyne.

W. H. PARKINSON,

FITTER.

AUG. KLÖNNE,

DORTMUND (GERMANY).

REGENERATIVE FURNACES.

Unsurpassed in Efficiency, Economy, Durability, and Easy Working.

For **FIRE-BRICKS,** the most durable for **GAS-FURNACES,**

ADDRESS

JAMES WHITE & Co., Limited,

ALBERT WORKS, WIDNES.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

CANNEL & COAL.

TYNE

BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

For Prices and complete Analysis, apply to

THOS. W. DANCE & SONS,

COAL OWNERS, NEWCASTLE-ON-TYNE.

OR

E. FOSTER & CO.,

21, JOHN STREET, ADELPHI, LONDON, W.C.

NIDDRIE CANNEL

A FIRST-CLASS CANNEL COAL,

Yielding a large volume of rich Gas, and fully 60 per cent. of first-class Coke.

FOR ANALYSIS, PRICE, AND ALL OTHER PARTICULARS, APPLY TO

The Niddrie & Benhar Coal Co., Ltd.,

4, York Buildings, Queen Street,

EDINBURGH.

Telegrams: "BENHAR, Edinburgh."

THORNLEY GAS COALS

WORKED BY THE

WEARDALE IRON AND COAL COMPANY, Ld.

OUT OF THEIR

THORNLEY AND WHEATLEY HILL COLLIERIES.

The Analysis made by Messrs. J. and H. T. PATTINSON, Public Analyst for Northumberland, gives 10,500 cubic feet of Gas per ton, with an Illuminating Power of 16·3 Candles and 67·3 per cent. of Coke. The following is a working Analysis made of these Coals by the Falmouth Gas Company:—

[COPY.]

FALMOUTH GAS COMPANY,

Offices: *Church Street, Falmouth, January 25th*, 1893.

Messrs. the

WEARDALE IRON & COAL COMPANY, LTD.,

NEWCASTLE-ON-TYNE.

GENTLEMEN,

From the Cargo of **THORNLEY GAS COAL,** received early this month from you, I have Carbonized at these Works, during a period of thirteen consecutive days, 151$\frac{5}{10}$ tons of the Coal, mixed with 9$\frac{6}{10}$ tons of Cannel Shale (or about 6 per cent.)

The Make of Gas during the above period was 1,624,000 cubic feet.

The whole of the Gas was made from four beds of sixes (24 mouthpieces); each charge being of six hours' duration.

Gas made: 1,624,000 cubic feet.
Coal Carbonized: 151$\frac{5}{10}$ tons.
Cannel Shale: 9$\frac{6}{10}$ tons.
Make per ton of Coal and Cannel Carbonized: 10,082 cubic feet.
Coke per ton (of good quality): 13$\frac{1}{4}$ cwt.

The ILLUMINATING POWER averages from 11 daily tests, **16·54 CANDLES,** which was ascertained by burning the Gas at the rate of 5 cubic feet per hour in a certified Letheby Photometer, fitted with a Standard Argand, each Candle consuming 120 grains of Sperm per hour.

Yours faithfully,

J. WM. BUCKLEY,

Engineer and Manager.

For Price, &c., apply to the

WEARDALE IRON & COAL Co., Ld.,

QUAYSIDE, NEWCASTLE-ON-TYNE.

WILLEY & Co.,

Gas Engineering Works, Commercial Road, Exeter,

MANUFACTURERS OF EVERY DESCRIPTION OF

GAS APPARATUS.

GASHOLDERS, Telescope and Single Lift, any size. Some of the largest in the Kingdom, erected by this Firm, are giving the highest satisfaction.

PLANS and SPECIFICATIONS furnished for **Extensions** and **Enlargement** of existing **Works,** adapting them to the most **Improved** and **Modern Principle** of **Gas Manufacture.**

PURIFIERS, CONDENSERS, WASHERS, ENGINES and EXHAUSTERS, STATION METERS and GOVERNORS, manufactured and erected.

Makers, by permission of that eminent authority **MR. GEORGE LIVESEY,** of his **CELEBRATED PATENT WASHER,** highly approved by all the Engineers of Works where adopted. Largely in demand.

Special reference and attention are invited to our

WET AND DRY METERS,

which have acquired a high reputation for the **excellence** of Materials and Workmanship; their **durability** and **accuracy** of **Register** guaranteed. They are used by several of the **London Gas Companies,** and over **200 Provincial Gas Companies.**

Price Lists, Specifications, and Estimates provided for any work appertaining to Gas Lighting, from the Retort-House to the Drawing-Room.

TROTTER, HAINES, & CORBETT,

Brettell's Estate

FIRE-CLAY & BRICK WORKS,

STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.

Proprietors of

BEST GLASSHOUSE POT & CRUCIBLE CLAY.

SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

THE SILICA FIRE-BRICK COMPANY,

OUGHTIBRIDGE, near SHEFFIELD,

MANUFACTURE

SILICA BLOCKS, BRICKS, AND CEMENT

OF SUPERIOR QUALITY

FOR GAS-FURNACES.

Trade Mark: "SILICA."

These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their

GREATER DURABILITY

Strongly recommended where EXCESSIVE HEATS have to be maintained.

UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD

BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.

RAVENSTHORPE, NEAR DEWSBURY.

T. B. KITTEL, SHEFFIELD.

CONTRACTS FOR SUPPLIES OF ANY OF THE PRINCIPAL

ENGLISH & SCOTCH CANNELS.

REAL SILKSTONE GAS COAL

ANALYSIS AND PRICES ON APPLICATION.

T. B. KITTEL, SHEFFIELD.

JAMES OAKES & Co.,

ALFRETON IRON-WORKS, DERBYSHIRE,

AND

Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1¼ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas Water, Railway, Telegraph Chemical, Colliery, and other Companies.

NOTE. — Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts, and covers, and rendering leakage impossible.

THOMAS TURTON AND SONS, LIMITED,

Sheaf & Spring Works,

SHEFFIELD,

MANUFACTURERS OF

FILES OF BEST QUALITY

FOR ENGINEERS.

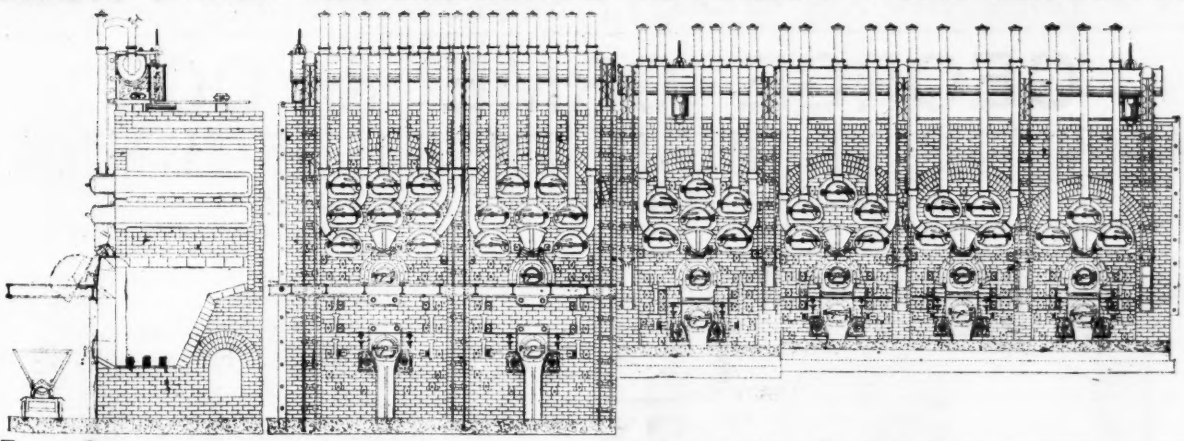
STEEL OF ALL DESCRIPTIONS.

SCREW STOCKS, TAPS AND DIES, SPANNERS, RATCHET BRACES, LIFTING JACKS ANVILS, VICES, AND ENGINEERS' TOOLS GENERALLY.

London Office:

90, CANNON STREET, E.C.

HISLOP'S PATENT REGENERATIVE SETTINGS OF GAS-RETORTS.



THESE SETTINGS ARE ADAPTED TO THE REQUIREMENTS OF ALL GAS COMPANIES AND GAS CORPORATIONS, AND HAVE ALREADY BEEN EXTENSIVELY ADOPTED: THEY ARE ERECTED UPON BOTH THE WORKING-STAGE AND SHALLOW-CHAMBER SYSTEMS, AND EQUALLY SATISFACTORY RESULTS ARE GUARANTEED IN BOTH CASES.

THE SETTINGS HAVE ATTAINED TO A MEASURE OF SUCCESS AND POPULARITY QUITE UNEQUALLED BY THAT OF ANY OTHER WITHIN THE SAME SPACE OF TIME. THE WORKING RESULTS OBTAINED, AND THE GENERAL SATISFACTION GIVEN, ARE DECLARED IN EVERY CASE TO EXCEED, AND IN MOST CASES CONSIDERABLY EXCEED, THE PATENTEE'S GUARANTEE. THE CONSTRUCTION AND WORKING OF THE PATENT PRODUCER AND THE PATENT CHARGING APPARATUS FOR SAME ARE ABSOLUTELY UNIQUE AND UNRIVALLED, AND ARE THE DELIGHT OF EVERY STOKER; WHILE IN EVERY OTHER PARTICULAR THEY SECURE THE HIGHEST RESULTS ATTAINABLE BY ANY REGENERATIVE SYSTEM, AND AT A MINIMUM OF COST.

Drawings and Specifications are furnished for the complete erection of Ovens, with or without Retort and Bench Mountings, or complete erection undertaken if required, and carried out by specially Trained Workmen.

Further particulars may be obtained on application to the Patentee's Agents: C. M. HAMILTON, 5, Stewart Street, Shawlands, Glasgow; J. E. FISHER, Stourbridge, and from R. F. HISLOP (son of Patentee), Gas-Works, Paisley.

HISLOP'S PATENT HYDRAULIC MAIN SEAL-REGULATING AND TAR-EXTRACTING VALVE is a *Sine quâ non* TO THE SATISFACTORY WORKING OF THE HYDRAULIC MAIN UNDER THE REGENERATIVE AS WELL AS OTHER SYSTEMS OF RETORTS. BEING LARGELY ADOPTED, AND AFFORDING THE HIGHEST SATISFACTION.

SPENT LIMES NO LONGER WASTE PRODUCTS

Under G. R. HISLOP'S PATENTS.

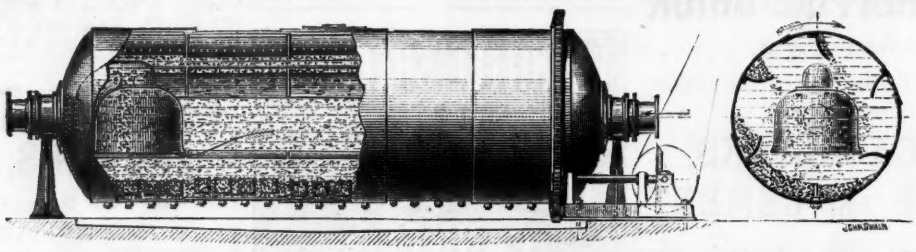
All Spent Limes are most effectually, economically, and continuously recovered at from one-third to one-half the cost of New Lime. The results are a surprise to all who have inspected the process, and are entirely satisfactory to all now using it.

Descriptive Pamphlets and Terms from Agents as above.

WATER PURIFICATION.

RIVER WATER and SEWAGE EFFLUENT successfully and economically treated in large volumes, by AGITATION WITH METALLIC IRON in

ANDERSON'S PATENT REVOLVING PURIFIER.



No Choking of Filter-Beds.
Colour due to Peat and Clay entirely Removed.
Simple & Rapid in its Action.
Organic Matter Considerably Reduced.
Microbes Totally Removed.

Made in Fourteen Sizes, capable of treating singly from **4000** to **1¼** Million Gallons daily.

REVOLVING PURIFIER COMPANY, LIMITED,

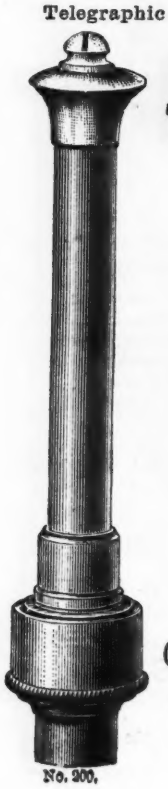
DOCK HOUSE, BILLITER STREET, LONDON, E.C.

GEORGE ORME & CO.,

MANUFACTURERS OF IMPROVED WET AND DRY GAS-METERS,

ATLAS METER WORKS, OLDHAM.

Telegraphic Address: "ORME OLDHAM." **Telephone No. 93, OLDHAM.**



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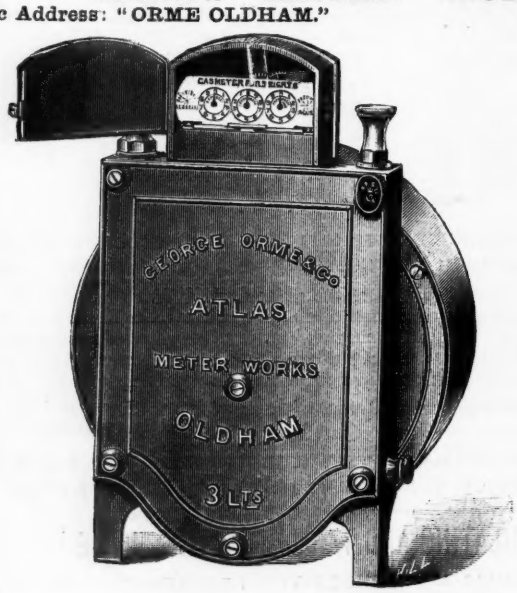
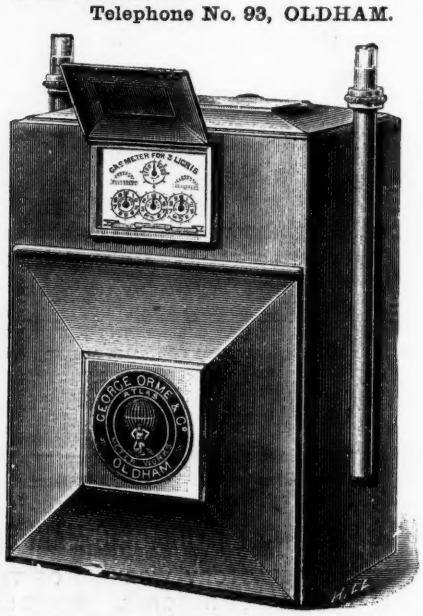


WET GAS-METER IN CAST-IRON CASE.



DRY GAS-METER IN STRONG TIN-PLATE CASE.

ORME'S GAS REGULATOR (BEHL'S PATENT) FOR STREET LAMPS,
AS ILLUSTRATION NO. 200.

Adopted by the leading London and Provincial Gas Companies: **More than 150,000 now in use.**

ORME'S PATENT SUSPENSION REGULATORS.

Prices and full particulars on application.

HEATHCOTE GAS COAL.

RICH IN ILLUMINATING POWER AND YIELD OF GAS.
ABOVE THE AVERAGE IN WEIGHT AND QUALITY OF COKE.
MAINTAINS A HIGH STANDARD IN RESIDUALS.

THE GRASSMOOR Co., Ld., CHESTERFIELD.

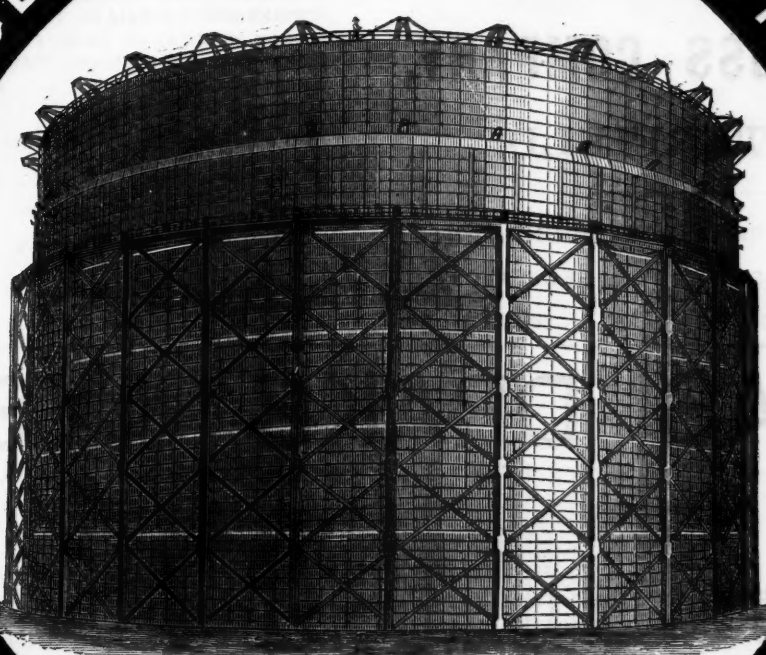
CLAYTON SON & Co, LTD

MAKERS OF

WORKS LEEDS

GASHOLDERS OUR SPECIALITY

THE LARGEST GASHOLDER IN THE WORLD. CAPACITY 12 MILLION CUBIC FT.



ERECTED AT EAST GREENWICH FOR THE South Metropolitan Gas Company
IT HAS SIX LIFTS 30 FT DEEP EACH AND IS 300 FT DIAR

MAKERS OF GAS PLANT OF EVERY DESCRIPTION

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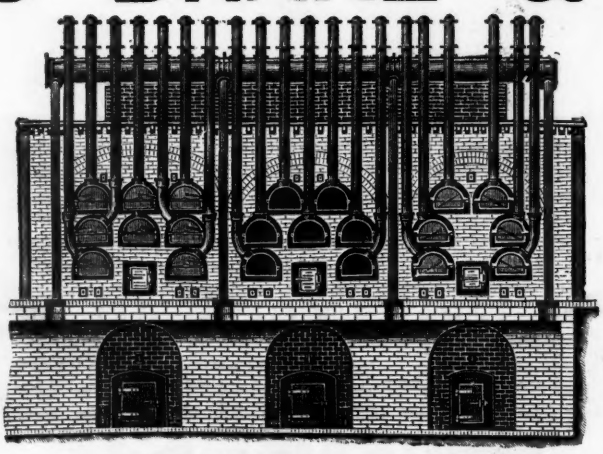

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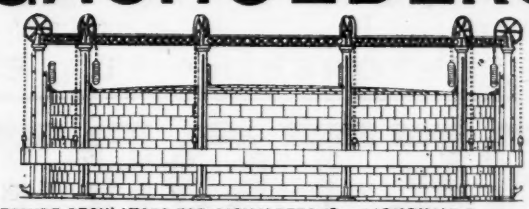

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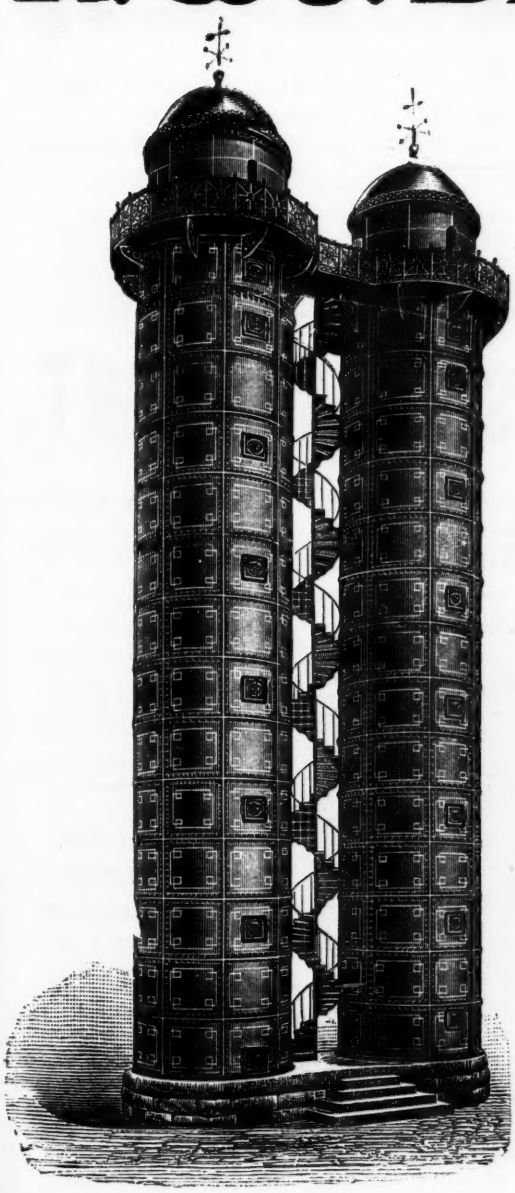

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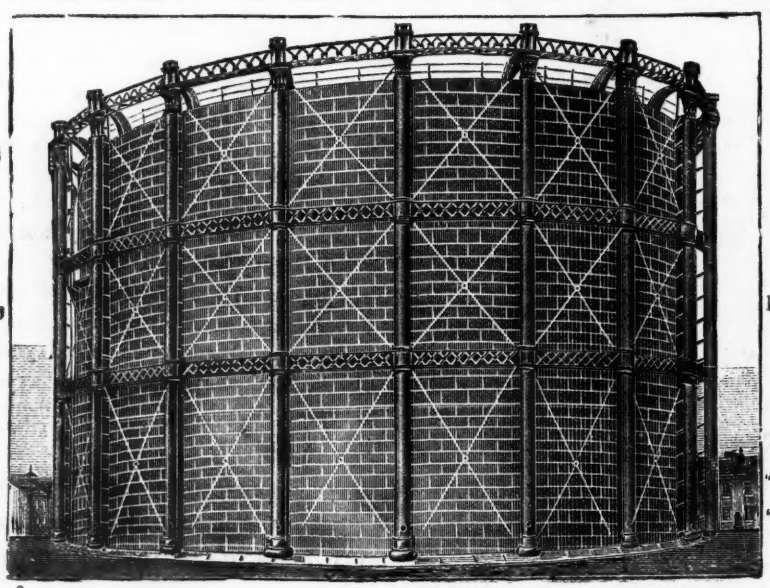

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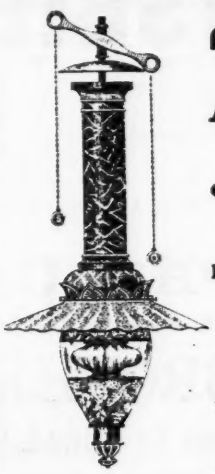

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